WAR EXPERIENCES OF A FRENCH AIR SCOUT

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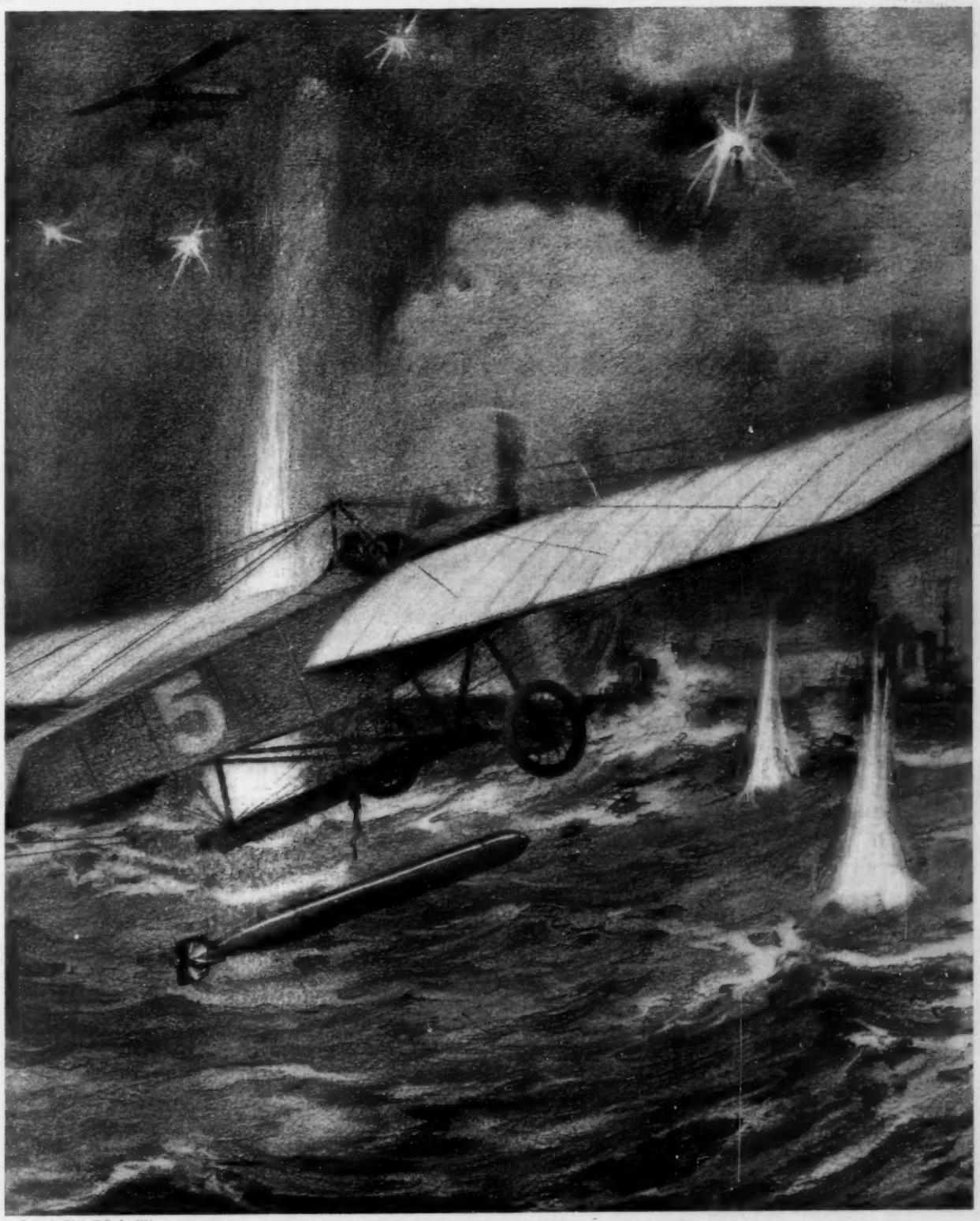

Drawn by Edwin F. Bayha, 1914

DELIVERING TORPEDO ATTACK BY AEROPLANE.—[See page 523.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Some Recent Naval Operations

THE past two or three weeks have been fruitful in naval operations, notably in the South Atlantic and the North Sea. In the first-named waters there was fought an engagement which must be considered as by far the most important of the present war; in the North Sea there was witnessed the first attack against the shores of England that has occurred for several centuries.

The crushing defeat and sinking of Germany's Pacific squadron by Admiral Sturdee was the natural sequel—we had almost said inevitable sequel—to the destruction of Admiral Cradock's squadron off the coast of Chile. In the last-named engagement the Germans, thanks to the admirably thought-out plans of their naval general staff and their wonderful system of naval intelligence, were able to catch a part of Cradock's squadron and attack and sink it with an overwhelming concentration of gun fire. Following upon this, it was inevitable that Great Britain should dispatch a fleet of vessels sufficiently fast and powerful to round up and sink the two armored cruisers and the few scout cruisers which made up Admiral Spee's Pacific fleet.

We know that the German fleet consisted of the armored cruisers "Scharnhorst" and "Gneisenau" and the scout cruisers "Nurnberg," "Leipzig," and "Dresden." The first four ships were sunk; the "Dresden" escaped to the Straits of Magellan and at the present writing is still being pursued by British cruisers. From the cabled dispatches, giving accounts of the action, it is evident that the British fleet greatly overpowered the German fleet; for it included an old battleship, two battle-cruisers of the "Invincible" type, 26-knot ships mounting 12-inch guns, and several fast cruisers of smaller size. That the fleet was powerful is suggested by the silence of the British government as to its composition; for if first-line ships had been detached from the Home Fleet for the purpose of finding and sinking Spee's squadron, it would be natural that the British Admiralty should not wish to make the fact of the absence of these ships from the North Sea, or from the Home Fleet, wherever it may be, known to the Germans.

It is conceivable that the weakening of the British battle-cruiser fleet may have had something to do with the recent raids by the German battle-cruisers along the British eastern coast. These cruisers are among the fastest of their class afloat, having speeds of 27 to 29 knots. Availing themselves of a dark winter's night, they passed through the line of blockading destroyers; and their presence in the North Sea was not known until, at dawn, they began a bombardment of a few seacoast towns, which appears to have lasted in no case more than half an hour. Immediately on the conclusion of the bombardment they turned and in all probability made direct for their home port. Their high speed enabled them to get back long before the fast battle-cruisers of the British, starting from their base on the British coast, or perhaps farther away, could hope to intercept them. At the present writing there has been no indication that they have been intercepted or have failed to return to their home ports.

Judged from the standpoint of strategy, it is difficult to understand the object of this raid; although it has been suggested that the Germans hoped to draw the British fleet into the open or lead them into some maneuvers, say in waters that were already infested with German submarines, in which they themselves could fight at an advantage. Failing that, the only probable outcome of the attack, which, in two cases, in defiance of the usages of civilized warfare, was made upon undefended towns, one of which, Scarborough, is a popular watering place, will be to stir up the martial spirit of the English and act as a powerful incentive at the recruiting stations.

As regards the main battleship fleet of the Germans, in which is included some sixteen dreadnoughts and battle-cruisers, there seems to be a division of opinion among naval men as to its probable course of action. There are some, a small minority, who believe that, because of the overwhelming strength of the British fleet, the Germans will not risk the loss of their own fleet in an open engagement, but will endeavor to preserve it intact in the Baltic, so as to save it as an asset for the final peace negotiations. The majority, however, believe that the great fight will take place at a time and under conditions chosen by Germany, and that, although she will probably suffer a crushing defeat, it will be at an enormous sacrifice of the ships of the victors. A German naval reserve officer predicted to the writer that when the Germans were ready they would challenge the British, and that the fight would take place on the Dogger Bank. This agrees with our conviction that the Germans will endeavor so to maneuver that the engagement will occur in waters which are sufficiently shoal to be mined. It is conceivable that their plan might be to endeavor to lead the British fleet over a previously laid mine field or into waters where a fleet of submarines was asleep on the bottom and within striking distance of the British battleship line.

The War, Industrial Research, and the American Manufacturer

THOMAS A. Edison's remarkable achievement in equipping a plant which would supply him with the carbolic acid required in the making of his phonograph records, and hitherto imported from Europe, has raised in the minds of many a thinking American the very pertinent question: Why cannot other manufacturers do likewise? To be sure all manufacturers are not Edisons. On the other hand they can lay their problems before research scientists who for a comparatively small outlay can devise processes which ought to render many an American absolutely independent of Europe. If the war stimulates this interest in industrial research, if it will be the indirect means of creating industries which it seemed impossible to establish in this country, the United States will profit far more than by the exportation of munitions of war and of foodstuffs.

But the problem of increasing our national wealth by industrial research involves much more than scientific investigation. The economic side must be considered as well. Our scientific experts are quite capable of solving any industrial problem that may be placed before them; but they cannot solve the problem of competing with cheap European labor. So long as there is a great disparity between wages paid in Europe and the corresponding wages paid in America, it will be hopeless in many lines of industry to achieve economic and industrial freedom.

More important still is the question of governmental co-operation. Germany's industrial greatness was attained not only because her schools graduated wonderful technologists, not only because the German has a natural love for order and system, but because there stood in back of each German manufacturer an intelligent government which created the proper conditions for the growth of industry and which smoothed the path of the industrialist in foreign countries.

The relation of industrial research to the improvement of those industries which have in a large measure depended on Europe for their raw material and the attitude of our Government toward industries which might flourish if the research scientist were only given an opportunity are problems which are of such vast significance that the SCIENTIFIC AMERICAN intends to take them up in a series of articles to be published early in the year. One of our editors has made a thorough study of the effect which the war has had upon American industries; he has interviewed the foremost engineers, business men, and manufacturers in our chief industrial centers; he has questioned Government officials on their attitude toward industries which must be developed not only by the scientific man, but by sympathetic legislative co-operation; and he has spent many days in the more important laboratories of this country in which industrial research is now carried on. In our opinion the SCIENTIFIC AMERICAN will publish in this series one of the most important contributions to the literature of American industry which it has ever made.

The Political Importance of Science

IN Shaw's much-discussed article, "Common Sense About the War," reference is made to militarism. Militarism cannot be considered a science because it does not reach the objective for which it ostensibly exists. A science of astronomy which never increases our knowledge of extraterrestrial phenomena is a bogus science. Bernard Shaw points out that militarism, the adoption of which is supposed to bring about certain desirable political consequences, does never, as a matter of fact, bring about those desirable consequences. Balance of power wars between States never, as a matter of fact, bring about the desired equilibrium. The political advantages aimed at are never attained. Therefore, since the science of militarism is incapable of reaching the results for which it exists, it is a bogus science.

So far we can entirely agree with Mr. Shaw. Now, although militarism is hateful and to be rooted out, it remains true that some of the political advantages it was supposed to bring about are themselves desirable. We all desire permanent peace between nations, but a peace based on community of interests and common ideals rather than on equality of force. A nation has often made a bloodless and mutually advantageous conquest of another nation by purely peaceful means. Who can doubt that the friendly relations between the United States and England are due, in an enormous degree, to the fact that they have a common language, which means very largely a common culture and common ideals? As Bernhardi points out, it would not be true to say that these two great nations have common commercial and political interests; nevertheless they are at peace and likely to remain so, largely because of their common language and all that such a bond implies. The spread of a language is fraught with highly important and desirable political consequences for the nation of that language. France influences Italy more and more because all over Italy is the French novel, as H. G. Wells points out. Now what influences the spread of a language? Primarily, and most permanently, the amount of thought contained in that language. Consider the fact that we English-speaking people practically have to learn French and German in order to keep abreast of our times. We don"t bother about learning Turkish because comparatively little of importance to us is expressed in Turkish. By raising the quality and quantity of valuable thought expressed through the medium of a particular language we increase the spread of that language, a spread which carries with it desirable political consequences of the greatest importance.

This causes a new point. By endowing and otherwise encouraging scientific research in a country we help to enrich the thought expressed in the language of that country; which makes for the extension of that language and never for the increased political importance of that country. We know that governments care nothing for knowledge as such, but we know they are interested in politics. Perhaps then, by insisting on the political importance of science we may get a government to consider more favorably the adequate endowment of scientific research.

Checking the Spread of Plant Diseases

THE Federal Horticultural Board, which represents the American end of a movement now becoming quite general in behalf of checking the spread of plant diseases and insect pests by means of suitable quarantine and inspection methods, has completed two years of effective work, some details of which are set forth in the second annual administrative report of the board, just at hand. In the course of the last fiscal year the board and its collaborators detected a great number of infested plants in process of shipment and proclaimed several quarantines, both domestic and foreign. In all, 191 species of noxious insects and 55 fungous diseases were reported on shipments from abroad. By preventing the entry of these pests the board has, in each case, headed off what might have proved a widespread disaster to American crops. An especially noteworthy case is that of the so-called pink boll-worm, which is now doing immense damage to cotton in Egypt, and was found on several shipments of Egyptian cotton seed offered for entry at the ports of New York and Boston. Its partly grown larva lives in the cotton seed and is thus easily transported. The situation is made more serious by the fact that the worm may be imported not only in seed shipped as such, but also in seeds which, owing to imperfect ginning, are left in baled Egyptian cotton. A number of living worms have been found in imported cotton bales, indicating a distinct danger from the use of such cotton, especially in southern mills, which are often situated in the midst of cotton fields. The board has recently co-operated with the Bureau of Standards in experiments to determine the practicability of treating baled Egyptian cotton to destroy all contained insect life, and in the meantime nearly all mills using imported Egyptian cotton have agreed to burn at the close of each day all picker waste and seeds from such cotton. Efforts are also being made to induce the Egyptian authorities to adopt some method of freeing baled cotton from this pest before shipment.

Electricity

Radium Lightning Conductors.—A new type of lightning conductors for which an uncommonly high degree of efficiency is claimed was described at a recent meeting of the French Academy of Sciences. In *Dingler's Polytechnisches Journal* (Berlin), of September 26th, an abstract is given of the report thereof in the *Comptes Rendus*. According to this the new lightning rod has 2 milligrammes of radium bromide inserted in its top. The result of this is said to be that the conductivity of the "cap" or sheath of air surrounding the top of the rod is enormously increased. It is, indeed, said to be many million times the conductivity of the air above an ordinary rod. Moreover, this increased conductivity can be detected at quite a great distance from the rod. Hence there is an unbroken interchange of electricity between this body of air and the air which generally precludes sudden discharges by means of "strokes of lightning."

Wireless Telegraph Recorder.—Efforts of inventors are being directed toward producing a good method for taking down wireless telegraph signals by the use of the common Morse recorder, so as to have a permanent record in dot and dash upon tape in the same way as for ordinary telegraphy. A Paris inventor, A. Chaudet, claims to have solved the problem by the use of a special relay for putting local battery current on the Morse apparatus, but unlike some of the methods that have appeared for this purpose, the relay is not operated by the minute current produced by the waves themselves, for an electric relay to work on such small current must necessarily be an elaborate and a delicate one, besides being expensive. M. Chaudet makes use of the mechanical impulses which are produced by a loud-speaking telephone, so that the vibrations of the telephone serve to set in movement a suitable relay, and this latter then makes the contact for the local battery circuit. This method appears to be quite a new one and has the advantage of simplicity and low cost. By the use of the loud-speaking telephone, the message can be read at any point in a large room, and the operator no longer needs to wear the customary telephone head-piece. When it is considered desirable, the telephone can be employed without utilizing the recording part of the apparatus.

The Rationale of Electroculture.—While an immense number of experiments have been carried out during the past one hundred and fifty years to ascertain the effects of electrical currents on plant growth, very little has heretofore been done toward explaining such effects as have been noted. Writing in the *Annals of Botany* (London) Messrs. R. C. Knight and J. H. Priestley refer to the experiments of Sir Oliver Lodge and others, indicating that an increased crop or an earlier ripening may be the result of electrical treatment, and describe their own experiments to determine whether these results may be due to the effect of electrical conditions upon the respiration of the plant. It was found that direct currents of a density 10^{-5} to 10^{-4} amperes have no effect upon the respiration of peas other than that due to accompanying changes of temperature, while overhead discharges producing a current density less than 3×10^{-6} amperes have no effect on respiration. Higher currents produce a definite increase in carbon dioxide, but this is attributed wholly to the rise of temperature caused by the discharge. Except by virtue of its temperature effect, an electrical current appears to have no influence upon the respiration of a plant, and in the usual field experiments the rise in temperature is negligible.

French Wireless Station in the Far East.—According to reports in the Paris journals, the new French wireless station at Shanghai will rank among the principal stations in the extreme Orient. The apparatus left France last spring, but the matter was kept secret for the time lest some other country should anticipate the movement. The station was set up in the French concession at Shanghai without its being made known to the public, and if the Chinese were surprised to see the installation, it is safe to say that the representatives of European governments, having concessions at this place, were even more so. The present station is of most modern fitting, and is the most powerful one yet to be put up in China, being designed to carry 600 miles in daytime and 1,200 miles at night. In practice these distances are much exceeded, for signals are picked up at 1,800 miles, thus reaching Saigon, in French colonial territory. Twice a day the station sends out weather indications and the local time. It gives vessels at sea all the data that may be asked for, and the post is in fact very well placed to furnish weather signals, for it is connected by telephone with the neighboring Zi-Ka-Wei observatory. The station also receives telegrams for ships, and when needed, it sends messages to the French administration at Quan-Chu-Wan and the government-general of Indo-China. In this connection it is to be noted that the construction of the present plant is due entirely to private enterprise, for it was established by a number of subscriptions taken up among the French colony non-residents at Shanghai.

Science

Amundsen's Proposed North Polar Expedition, which, after having been twice postponed, was to have sailed next summer, has now been indefinitely postponed, on account of the European war.

"Hunting with the Camera" is permitted, under certain restrictions, on the national bird reservations, where of course a particularly happy hunting ground is offered to the photographic sportsman. Permits are granted only after eggs have hatched, and operators are allowed to work only when accompanied by a warden, so that the birds may not be unduly disturbed. Malheur Lake and Klamath Lake, Oregon, and Clear Lake, California, have been favored by the photographers.

Smithsonian Explorations.—Following its custom of recent years, the Smithsonian Institution has just issued a readable and attractively illustrated summary of the various expeditions and other forms of field-work conducted by the Institution and its several branches during the year 1913. The first section of the report, giving an account of Secretary Walcott's geological explorations in the Canadian Rockies, is illustrated with several beautiful photographs of mountain scenery, in the making of which Mr. Walcott excels. The other undertakings recorded in this report are mainly biological and anthropological, and extend over a considerable part of the world.

Philippine Asphalt.—Several recent reports from the Philippines have indicated that much importance is attached to the discovery of asphalt deposits in those islands. If the deposits should prove to be extensive, the Far East generally would benefit by the discovery, as the asphalt used there is now all imported from Europe and the United States, especially from the latter. The latest information is that the deposits consist of the variety of hard asphalt known as uintahite (from the Uinta Mountains, in Utah, where this mineral is found in abundance); also as gilsonite. They lie a few miles inland from the west coast of the island of Leyte, somewhere between the towns of Villaba and Leyte, and several mineral claims have already been located in the vicinity of the principal outcrop.

Clare Island, off the west coast of Ireland, famous in Irish history as the home and headquarters of the sixteenth century chieftainess Grace O'Malley, is the subject of a remarkable series of memoirs now in course of publication by the Royal Irish Academy, and constituting what is called the "Clare Island Survey." The investigations represented by these memoirs were carried out by over one hundred specialists in the years 1909-11, and cover the flora, fauna, geology, meteorology, etc., of the island and the adjoining mainland. This particular spot was chosen as a typical area of the west coast of Ireland, a region which provides some of the most interesting faunistic and floristic problems of Europe. It is claimed that the report when finished "will provide the most complete survey of the fauna and flora of a definite area which has ever been made." Special attention has been given to questions of geographical distribution, dispersal, and ecology, and to the influence of human operations upon the flora and fauna. The report will include descriptions of some 50 species of plants and animals new to science, besides records of about 200 species new to the British Isles, and at least 1,000 new to Ireland.

A World Weather Bureau has been the cherished dream of many meteorologists, and in the current number of *Symons's Meteorological Magazine* Messrs. W. M. Hays and H. H. Clayton outline plans for such an institution, especially with a view to its use in improving crop estimates. It is pointed out that "the weather is the one great varying factor in crop production," and that by using the local records of temperature and rainfall and of destructive storms the prospects of crops can be foretold, often before the crops themselves indicate results of climatic changes. The proposed bureau would cooperate closely with the International Institute of Agriculture, in Rome, which was founded primarily for the purpose of putting the work of crop reporting throughout the world on a rational basis. We would suggest, however, that an international meteorological institute might properly undertake certain tasks not mentioned by Messrs. Hays and Clayton. One of the most urgent desiderata in meteorology is the collection, unification, and publication of climatic statistics from all parts of the world. At present such data as exist are fragmentary and heterogeneous even for the countries where climatology has been most assiduously cultivated. For example, we have hardly any statistics of the annual and monthly snowfall in most parts of Europe, where such information would be of great interest just now in connection with the war. On the other hand, there are vast regions—notably in South America—for which no climatic statistics of any kind exist. An international weather bureau, analogous to the magnetic bureau of the Carnegie Institution, would promptly enlist the services of missionaries, planters, etc., in these neglected regions in the task of filling up the gaps in the present *réseau* of meteorological stations.

Automobile

A Michigan Inventor's "Rubber Foam."—The French material, called "caoutchouc foam" which was described in a recent issue of the SCIENTIFIC AMERICAN, has an American counterpart, patented under No. 1,115,031, by a Muskegon (Mich.) inventor named Staunton Gray. According to his method, the rubber compound is mixed with a light hydrocarbon solvent, preferably benzol, benzine or xylol, and brought to a fairly stiff constituency. It is then placed in a vacuum and the vulcanizing agent is added for a sort of "cold" vulcanization.

Motor Fuel in Germany.—Late information from Germany is to the effect that alcohol and benzol are the fuels now used almost exclusively by the government cars of all descriptions, and that the only motors that absolutely require gasoline are those in the fast aeroplanes. This has released the pressure on the supply of gasoline, and the embargo placed on this fuel at the start of the war has been raised, so that private owners, at least those who have been able to retain their cars, find no difficulty in getting supplies most anywhere. Benzol and alcohol are used either separately, or mixed, and there are several carbureters in use in Germany that will handle these fuels satisfactorily.

Automobile Trade in South Africa.—A Vienna journal states that according to consular reports, automobile imports in British South Africa for the year 1913 reached $5,504,000, compared with $2,790,000 for the preceding year. Half of this great import trade enters the country by way of Port Elizabeth. Out of the above total, the amount for Great Britain is $2,200,000, in round numbers; United States, $1,920,000; Canada, $800,000; Germany, $3,000,000. As regards France and Italy, who formerly dominated the South African market, they now figure for only $1,900,000 and $101,000 respectively. The tendency of the African importers is to seek a low-priced car, and this favors the extension of American, Canadian and German trade.

English Makers Abandon Annual Models.—Some English builders of pleasure cars have abandoned the old plan of bringing out a new model each year, which is adhered to during the succeeding season, and now incorporate any idea that they consider a desirable improvement in each new lot of chassis that is turned out. One influence that has tended to bring this about is the greatly decreased demand for pleasure cars at the present time in England. This weak demand for pleasure vehicles is making itself evident in another direction, for makers who have heretofore turned out four or five different powered cars are restricting their output to two or three sizes, a result that is probably desirable for many reasons.

Folding Ribs on Inner Tubes.—Preventing puncture of inner tubes of automobile tires is one of the most prolific fields for the inventor. Hundreds and even thousands of schemes have been devised, some of them working very satisfactorily. One of the latest, which is as unique as it is said to be effective, is the placing of three separate and distinct ribs on the inner tube. The shape of these ribs is such as to form small airspaces when the tube is blown up, thus adding considerably to the resiliency of the tire. The greater thickness of the inner tube and the difficulty which a nail or tack would have to penetrate the entire tube recommend this invention to the attention of the motorist. The few tubes made according to this design are stated to have given great satisfaction.

Two Ingenious Automobile Devices.—Two new devices designed for attachment to automobiles that recently have made their appearance on the market give evidence of considerable ingenuity. The first of these is designed to show when a car is used without the authority of the owner. It consists of a small case containing clockwork which unwinds a strip of paper past a needle. The needle is fastened to a delicately balanced horizontal pendulum and perforates the paper when moved by the vibration of the car. The tape is marked off in divisions of time so that the perforations indicate not only when the car was used but also the length of time. The other device would seem to have been long in demand. It is a simple grease cup with a quick detachable lid so that the cup can be quickly and easily filled. The lid is held by a bayonet lock.

How Would You Disable a Steam Automobile?—The present European imbroglio which is tearing at the vitals of foreign countries has already had a number of curious results. Not the least curious is a contest which has been started by a foreign contemporary with prizes for the best answer to the question, "How would you disable a steamer?" The disablement, needless to add, is to prevent the vehicle getting into the hands of the enemy in workable condition. Quite a number of contestants have suggested that the valves of the pump and injector be removed; others, have suggested hundreds of other ways in which a car might be temporarily disabled without working permanent injury. The prize winner, however, suggested that the motion blocks be removed. These are easily taken out and carried away, and cannot easily be replaced.

War Experiences of an Air Scout—I*

The Diary of an American Volunteer With the Aviation Corps of the French Army

By Frederick C. Hild

The author of this article, a well-known aviator in this country, was impelled by a spirit of adventure to seek his fortune with the French army. His tedious experiences with French red tape before being admitted to service, the tests he was obliged to undergo before qualifying as an army scout, his flights over the enemy's camps, and finally a most thrilling battle in the clouds far within the German lines, together with a number of the interesting side lights on the conditions in France during the war, are described in a series of three articles, of which this is the first.—EDITOR.

ON the outbreak of the great European war I was seized with the desire to participate in the conflict, and this desire grew day by day until finally I was obliged to yield to it.

It mattered little to me which of the warring nations I would join, and finally I chose to throw in my lot with the army possessing the largest number of aeroplanes. Having been a close observer of aviation, both here and abroad, for the past four years, I came to the conclusion that France possesses the greatest number of aircraft, and so I applied to the French government, on August 31st, through its consul-general in New York city.

My application was immediately acted upon and my voluntary services accepted. It was arranged that I should leave New York Saturday, September 5th, on the French Line steamer.

Up to the week before my departure from the United States I had been giving weekly exhibitions of flying throughout New Jersey, and I immediately canceled further contracts and placed my 60 horse-power aeroplane in storage.

The French consul-general presented me with two important letters of introduction, one addressed to the consul-general of France and the other a personal letter addressed to Gen. Goiran, the mayor of Nice; but should Gen. Goiran not be conveniently located, the presentation of the letter to any military official in France would accomplish for me the same purpose.

Off to the War.

When the French steamer "Espagne" left New York, on September 5th, I was on board, together with several Americans and about 700 reservists, who were going to France to fight their country's battles. There was much fun and excitement during the voyage, pleasant weather favoring us during the entire journey. The cabin passengers were shown every consideration, but the 500 reservists traveling third-class were treated no better than cattle, which was rather uncalled for, when it is taken into consideration that they were leaving their families and friends to defend their country's honor. Two days out the French Line published a circular called "Catéchisme du Soldat à la Guerre," which was circulated among the male passengers, and from then on the reservists were obliged to drill for several hours each day under the supervision of a French officer, several of whom were aboard.

Upon nearing the French coast we were accosted by two British warships, which escorted our steamer close to the port of Havre. We landed at Havre on September 14th, at 7 A. M., in a heavy rainstorm. The French officials were taking no chances of allowing an enemy to land, because we had to show our papers the day before we landed, and then to the military authorities the day we disembarked on French soil.

Red Tape at Havre.

Together with a fellow aviator, a Mr. A. Fileux, a native of France, whom I had known for several years and who returned to France on the same steamer to serve his country, we went to the Bureau de Recruitement, at 55 Rue de Phalsbourg, where, upon presentation of my letters from the consul-general at New York, I was given an immediate interview with the commandant. As I could not speak any French, Mr. Fileux acted as interpreter for me and smoothed away my difficulties.

The commandant looked through my papers carefully, and after convincing himself that I was the party named therein he informed me that he must telegraph to the Minister of War at Bordeaux for instructions, and must await reply. My case was a new one to the recruiting office at Havre, as he had not dealt before with any Americans who wished to join the aviation corps. In the meantime, while waiting for the reply, I was to pass the physical test and sleep in the dormitory of the Sixty-ninth Regiment, the barracks of which were a few blocks off.

After luncheon I visited the Sixty-ninth Regiment barracks, where a great many of the soldiers there were engaged in throwing beds out of the upper story windows, which later were carted away, and I learned from the captain in charge that as there were only

(Concluded on page 530)

The author in his French uniform.

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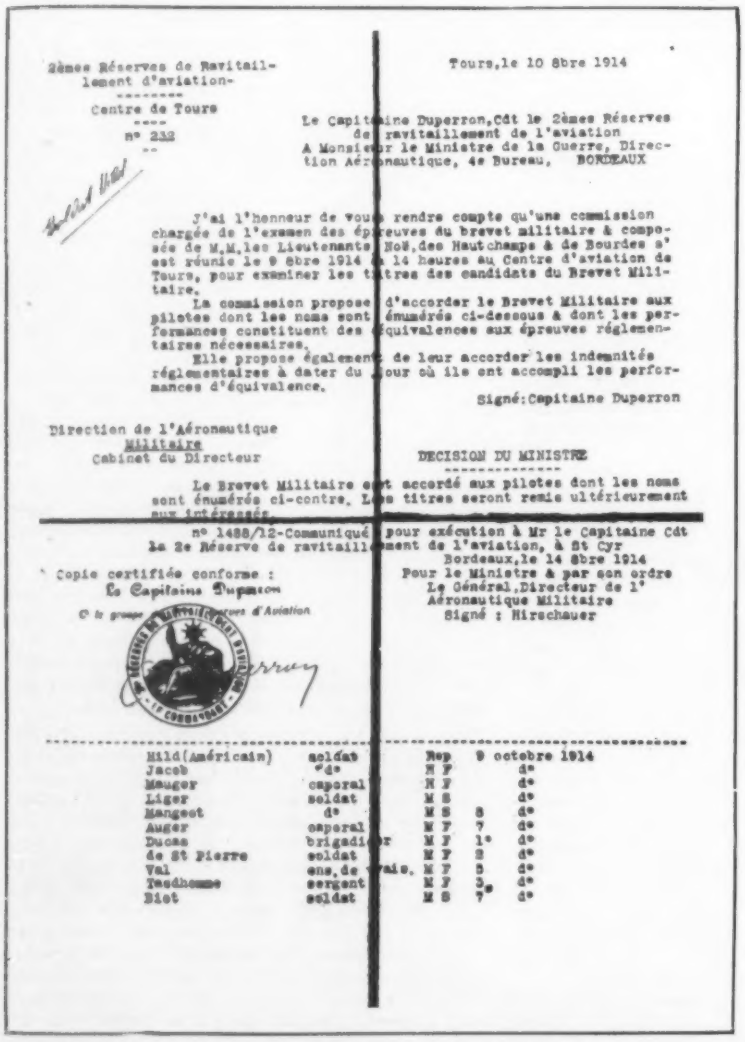


2èmes Réserves de Ravitaillement d'aviation-
Centre de Tours
nº 232

Tours, le 10 8bre 1914

Le Capitaine Duperron, Cdt le 2èmes Réserves de Ravitaillement de l'aviation
A Monsieur le Ministre de la Guerre, Direction Aéronautique, 4e Bureau, BORDEAUX

J'ai l'honneur de vous rendre compte qu'une commission chargée de l'examen des épreuves du brevet militaire & composée de M.M. les Lieutenants Noë, des Hautchamps & de Bourdes s'est réunie le 9 8bre 1914 à 14 heures au Centre d'aviation de Tours, pour examiner les titres des candidats du Brevet Militaire.

La commission propose d'accorder le Brevet Militaire aux pilotes dont les noms sont énumérés ci-dessous & dont les performances constituent des équivalences aux épreuves réglementaires nécessaires.

Elle propose également de leur accorder les indemnités réglementaires à dater du jour où ils ont accompli les performances d'équivalence.

Signé: Capitaine Duperron

Direction de l'Aéronautique
Militaire
Cabinet du Directeur

DECISION DU MINISTRE

Le Brevet Militaire est accordé aux pilotes dont les noms sont énumérés ci-contre. Les titres seront remis ultérieurement aux intéressés.

nº 1488/12-Communiqué pour exécution à Mr le Capitaine Cdt le 2e Réserve de ravitaillement de l'aviation, à St Cyr
Bordeaux, le 14 8bre 1914
Pour le Ministre & par son ordre
Le Général, Directeur de l'Aéronautique Militaire
Signé : Hirschauer

Copie certifiée conforme :
Le Capitaine Duperron

Hild (Américain)	soldat	Rep	9	octobre	1914
Jacob	id°	N F		id°	
Mauger	caporal	N F		id°	
Liger	soldat	M S		id°	
Mangeot	id°	M S	8	id°	
Auger	caporal	M F	7	id°	
Ducas	brigadier	M F	1°	id°	
de St Pierre	soldat	M F	2	id°	
Val	ens. de vaiss.	M F	5	id°	
Taudhomme	sergent	M F	3	id°	
Biot	soldat	M S	7	id°	

Mr. Hild's commission as pilot in the Aviation Corps.

Catechism of a Soldier in Time of War

To conquer in war I must have:

My courage,

My discipline,

My bayonet,

My ammunition.

My courage, to assure long suffering.

My discipline, in order to carry out blindly all the orders of my commander.

My bayonet, to drive the enemy from his position or to impale him.

My bullets, to permit me to press on up to the moment of assault.

As a sentinel I watch over the army; it is my duty to keep on my feet, in order to see, to listen, and to prevent danger.

As a scout I must protect the army on the march and be audacious in obtaining information.

On the march I must keep my place exactly.

In camp I must look after my equipment, care for my feet, my boots, rest with my rifle near me, so as to be ready at the first call to arms.

In battle, in taking the offensive my motto must be "Always forward" for the assault.

On the defensive I must hold out to the very end, even when I see the effect of fire, commencing and ceasing fire instantly at the order of my commander, supporting my rifle and, if possible, my body in order to fight the better.

When I am alone I will not fire, at more than 400 meters, on a single man, or at more than 600 meters on a group of men.

Given this day on the boat "Espagne."

Sunday, September 13th, 1914.

Translation of orders given to French soldiers.

Fig. 1.—Mount San Antonio, as seen from San José, Costa Rica. Photographed in infra-red light.

Air Transparency for Infra-Red Rays*

Application of These Rays to Telephotography

By G. Michaud and J. F. Tristan,
Costa Rica State College

Fig. 2.—Same view as Fig. 1, made without a screen on an ordinary fast plate.

THE cause of the various and beautiful colors which the sky and clouds may assume was but little understood a few years ago, and even when Lord Rayleigh showed that the scattering of light by gaseous molecules was the greatest when the wave-length of light was the smallest, he probably did not realize at once that he had found a satisfactory explanation for all the colors, whether blue, green, yellow, or red, which can be observed in the sky, from midday till after sunset.

Ultra-violet, violet, and blue are, in the order in which they are named, the radiations which are most scattered when solar light passes through a thick layer of air. Ultra-violet is invisible and the remnant mixture of violet and blue appears to us as blue, owing to the fact that blue acts more powerfully on our retina than violet does. Such is the cause of the blue color of the sky. The atmosphere acts as a ray filter, which scatters in many directions most of the ultra-violet, violet, and blue, and allows the passing of most of the yellow, red, and infra-red. If, some time before sunset, an observer turns his back to the sun and holds vertically above his eyes a sheet of white paper, in such a way as to have the direct rays of the sun fall upon the paper, while he sees both the blue sky and the paper side by side, he has an opportunity to compare the color of the ray filter with that of the filtered rays, i. e., the color of the light scattered by the atmosphere with that of the light which has passed through it and which is reflected by the paper. Even at noon, in June, in the northern hemisphere, when the atmospheric ray filter is as thin as it may be for a given altitude, the paper is tinged with a yellowish hue. Painters are aware of that fact, and, as a rule, exaggerate the yellowish effect when they wish to brush a sunny spot.

White light which has lost some of its blue and violet components appears as yellow. If, however, it has lost not only the ultra-violet, violet and blue, but also part of the green, that is to say part of the wave-lengths which come next to the blue in the list of colors arranged by order of decreasing wave-length, red as well as yellow predominates in it and gives it an orange or even reddish hue. Such a phenomenon occurs at sunrise and sunset, when the sun is near the horizon and when, owing to the great obliquity of its rays, the thicker atmospheric filter has begun to scatter a notable proportion of the green radiations. Such a thick layer of air remains fairly transparent, then, only for the less refrangible wave-lengths: orange, red, and infra-red. High clouds, when illuminated by rays thus filtered, take beautiful orange and red colors.

Occasionally, long after sunset, when general darkness has come, in atmospheric conditions the nature of which has not yet been made quite clear, a corner of the western sky will be seen to assume a deep ruby color which the physicist who has somewhat dabbled into spectral studies will readily recognize as the extreme spectral red. Sunlight, in such circumstances, has traveled through a maximum thickness of air. It probably illuminates tenuous dust particles which stand far above the clouds, with a light in which only the greater wave-lengths, extreme red and infra-red, have been left; a light which the eye could not perceive were it not for the fact that everything else has been submerged into darkness. It would be extremely interesting, when such phenomenon occurs, to take a photograph of the western sky with a plate sensitive to the infra-red, some time after the vanishing of the very last glow of visible light. That an impression would be made on the plate is probable, as the invisible infra-red radiations will still pass through an atmospheric layer of such a thickness as to intercept every other radiation.

This curious property of infra-red light suggests its application to telephotography. If the eye could be made, even temporarily, sensitive to the infra-red, the same property would find a ready application to television, as one of the greatest obstacles to a clear vision of far-away terrestrial objects through a powerful telescope is the blue haze which wraps and partially hides everything. Telephotography with infra-red light was attempted for the first time by us in 1912, with Prof. Wood's filter. The results, which have been published elsewhere, were encouraging enough, but the length of exposure (from 15 to 20 minutes for a sunny landscape, with the greatest lens aperture) forbade many applications. As the sensitiveness of ordinary plates comes to an end with any wave-length longer than that corresponding to the green, special plates, manufactured by the English firm, Wratten & Wainwright of Croydon, were used for those early attempts. These plates, expressly made for spectral studies, are somewhat sensitive to the infra-red, but only as far as wave-length 8,000 A. U. owing to the fact that the main object of their makers is sensitiveness, not so much to extremely long wave radiations as to every visible radiation.

During several attempts to carry this sensitiveness farther on the infra-red side of the spectrum, the writers used most of the dyes which have been recommended as good sensitizers for the red, namely: cyanin, dicyanin, chlorophyl, alizarin blue S. They found in the last named of these dyes a sensitizing agent which, when used in combination with silver nitrate, besides allowing them to reach a region of the spectrum which was probably *terra incognita* for the photographers, reduces the exposure to some two minutes, for a sunny landscape, with diaphragm one eighth. Such plates are easily sensitized and yield constant results, but must be dyed by the experimenter himself, as they begin to lose their remarkable optical properties a few hours after being sensitized.

The accompanying photographs of mountain ranges some 8 to 15 miles from the city of San José, Costa Rica, give an idea of the wonderful clearness of vision which would be bestowed upon our retina with the gift of sensitiveness to infra-red light. Fig. 4, made on an orthochromatic plate, with a weak yellow screen, shows the far-away, hazy, mountain about as it appears to the eye. In photographs (not here reproduced) made with about the shortest wave-lengths (3,160 to 3,260 A. U.) found in sunlight at sea level, the mountain range has all but vanished. If ultra-violet wave-length 2,118 A. U. were contained in sunlight in the lower regions of the atmosphere, and could

(Concluded on page 531.)

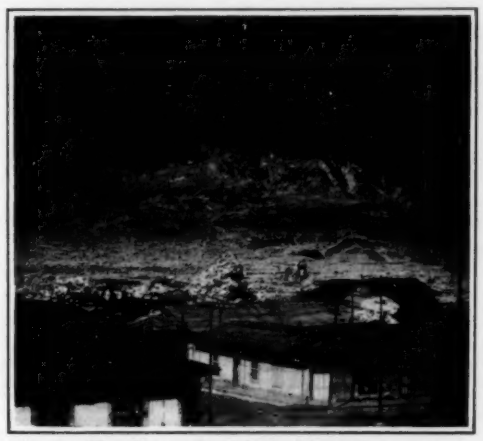


Fig. 3.—The Sierra Candelaria Mountains, as seen from San José, Costa Rica. Photographed in infra-red light.

Fig. 4.—Same view as Fig. 3, made on an orthochromatic plate with a weak yellow screen. Distant objects appear about as the eye sees them.

* *La Nature*, September 7th, 1912.

Fig. 5.—Dragon Mountain, as seen from San José, Costa Rica. Photographed in infra-red light.

Fig. 6.—Same view as Fig. 5. Photographed without a screen on an ordinary fast plate.

An English officer instructing a scouting party with a model of the seat of war made in sand.

Strategic Moves of the War

Letter from the Military Correspondent of the Scientific American, December 19th, 1914

The Campaign in France and Belgium.

THE general aggressive campaign of the Allies to drive back the German line has not developed definitely yet, but many signs point to increasing activity on the part of the former. The beginning of such a campaign would naturally consist of attacks all along the line from Switzerland to the North Sea coast. In this way the Allies would try out the strength of the German defense and would be able to locate the points at which a further attack in strength would have best chances of success.

Two important considerations impel the French and British to adopt a vigorous campaign at the earliest moment warranted by the state of their military preparedness. One is the decrease in power of the German armies that would result from demands for active operations on both their eastern and their western borders. The other is the impossibility of considering peace terms while Germany occupies a large part of Belgium and France.

It seems evident that all of the combatants are withholding news of their movements for several days in order to avoid giving information to the enemy. While the enemy of course know of the fact of the attack on certain positions, they necessarily have only an uncertain estimate as to the importance of this move in their opponent's plans. The dispatches of each army to its home government are valuable information to the enemy in that they betray inside history of the plans. For this reason it is out of the question for any first rate military power to permit real news of the operations of the armies to be published without restriction.

It was such a dispatch, published in the London *Times* in August, 1870, that is credited with betraying to the Germans the move of Marshal MacMahon's army to relieve Metz. After a three days' march toward Paris on the mistaken estimate that the French army would be found there, the German armies received the correct information, turned north, and succeeded in surrounding MacMahon's army at Sedan and forcing its surrender.

The majority of the affairs reported during the week were along the northern part of the line between Arras and the coast. The most notable gain by the Allies was made at Ypres, where the British troops pushed forward a salient for five miles along the railroad toward Rouers. The German line has held firm on both sides of this point, so that the British are as yet insecure in their possession of this ground recently gained. By attack at Zillebecke, three miles southeast of Ypres, and at Langhemarck, four miles to the northeast, the Germans attempted unsuccessfully to break in the flanks of the British salient.

A new attempt of the Allies to advance along the coast during the last part of the week was less successful in spite of the assistance of the naval gunboats in bombarding the German position near Westende. The Germans repulsed these attacks with large losses. This field is the most likely line of advance for the British and Belgians when they start their much-heralded forward move. If these attacks are strongly pressed it will indicate the commencement of this aggressive move.

The confidence of the French in their present position is indicated by their admission of earlier reverses that have been concealed until now. In the Chaulnes and Roye district the French have regained Rouvroy, Parvillers, and Andechy, three miles west of the line of the above cities. While the French seem to have now regained the upper hand in this district, they were evidently driven back three miles in the fighting of the preceding month.

The plateau in the angle between the Aisne and the Oise rivers has been the scene of especially vigorous fighting since the armies first confronted each other in this district in September. Tracy-le-Val has changed hands a number of times. In spite of repeated attacks and counter-attacks, the opposing lines have not changed position materially.

From this point to the Vosges Mountains the opposing lines have nowhere moved sufficiently to show on even a large scale map. At Varennes, where the battle line crosses the upper Aisne, and at Ailly and Apremont, one and five miles east of St. Mihiel, the French have made repeated but unsuccessful efforts to break through the German lines.

In Upper Alsace the Germans have not only checked the French invasion, but have recovered ground to a slight extent at both points. East of Thann they have recaptured Steinbach. By a flanking move along the Swiss border they reached Pfetterhausen on the French border and forced the French to fall back to a position west of Altkirch.

Considering the entire battle line in France and Belgium, the advantage in the fighting during the week lies with the Allies. The numerous attacks that they are now making show a marked change in their plan of operations. A significant item in the dispatches is the frequent report of heavier guns in the French artillery. If they have made good their deficiency in this type of armament, their chances will be much strengthened in case they should undertake an aggressive move.

The most noteworthy feature of the fighting in this field has, however, been the success of the Germans in holding back largely superior forces for over two months while delivering their great effort against Russia. The military resources of the nation are necessarily limited; the operations in Russia indicate a strength of probably 1,500,000 men for the eastern campaign. It seems unlikely, then, that they can have more than 2,000,000 men for the western campaign. The British, French, and Belgians must outnumber the Germans by five to four, or even more.

The Campaign in Russia.

The most important moves of the week were on the flanks of the great battle line that stretches from the Carpathian Mountains to the East Prussian border north of Warsaw. From the north the Germans rushed forward an army from Soldau in the effort to get behind the Russian right flank. At the same time the Austrians made an advance from the Carpathian Mountains in an attack on the rear of the Russian left flank.

The German expeditionary army under Gen. Francois advanced from Osterode and Soldau in East Prussia and defeated the Russians southeast of Mlawa. Their further advance carried them to Przasynsz and Ciechanow, twenty-five miles south of the German border.

Their object in this move was not to waste time and men in an attack on the great Russian fortress at Novo Georgievsk on the Vistula northwest of Warsaw. It was to strike southeastward toward Pultusk and Rozjan in an effort to capture the main railroad running from Warsaw to Petrograd. This line of communication is so important for the Russians that they would necessarily have to rush a large number of troops for its defense. The Russian campaign west of the Vistula would be correspondingly weakened.

On December 14th the army of Gen. Francois was defeated at Ciechanow and was forced to fall back to its former position near Mlawa. This relieves the Russian right flank of danger and enables them to give greater strength to their battle line west of Warsaw.

On their left flank the campaign has been going in favor of the Austrians. The Russians had advanced to Wieliczka and Dobcyce, ten miles from Cracow. The advance of an Austro-German army along the railroad toward Novi Sandec so threatened this exposed Russian position that they were forced to fall back to Niepolemice, fourteen miles east of Cracow.

An important flanking move was made by the Austrians through the passes of the Carpathians farther to the east. They moved northward in large force and captured Dukla. By a further advance to Jaslo they cut off the Russian army at Novi Sandec and force it either to retreat northward toward Tarnow or to fight under disadvantageous circumstances. If the Austrians are able to press this flanking move through Jaslo they will to a large extent relieve the pressure on Cracow.

In the center of this battle line from Czenstochowa to the Vistula River the Germans succeeded in pressing back the Russian line to a position running through Radomsko and Lodz to Lowicz and then along the Bzura River to the Vistula. The Germans have continued their efforts to press forward east of Lowicz, but the Russian defense seems to have strengthened and has checked the German invasion on the above line.

By making this advance of sixty-five miles into Poland the Germans have very largely lost the advantage in mobility furnished by their excellent railroad system. They now depend upon a seventy-mile stretch of communications by highway. The railroads have

(Concluded on page 531.)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

An Opinion of Our War Number

To the Editor of the SCIENTIFIC AMERICAN:

I am tremendously impressed with the technical value of your War Issue No. 4. I know what it means in time, toil, and expense in the mere assembling of the material you offer readers in that issue. It is a most creditable number, of a unity and harmony of design that is marvelous, even to me.

New York city. THOMAS J. KEENAN.

Images by Small Apertures

To the Editor of the SCIENTIFIC AMERICAN:

The method of observing spots on the sun by allowing its light to pass through a small hole and form an image on a piece of white paper, which is mentioned in your issue of October 31st and reported as new by the Carothers Observatory, is the familiar one known in optics under the name of "images by small apertures." While no discourtesy is intended, it is surely of interest to look at the title page of Father Scheiner's "Rosa Ursina," published about 1634, in which the method is presented in an elegant illustration. It has been frequently mentioned by the present writer in his popular essays, as for example in the Omaha *Bee* and *World Herald* on February 4th, 1905. And once, on June 28th, 1908, at Cincinnati, Ohio, having no telescope at hand, he even observed in this way, within a few seconds, the beginning and end of an eclipse.

Omaha, Neb. WILLIAM F. RIGGE.

Garage Fire Due to Static Electricity

To the Editor of the SCIENTIFIC AMERICAN:

The results of some experiments made in an attempt to explain the cause of a recent fire in a garage, appear to be worth calling to the attention of automobile owners in general.

The fire in question seemed to come from no apparent cause while the tank of the car was being filled with gasoline. The gasoline was being run into the tank through a funnel with a strainer of chamois skin, and the gasoline in the funnel was suddenly noticed to be on fire.

If the bottom of a metal funnel is covered with chamois skin, cotton cloth, or other material through which the gasoline develops considerable friction in passing, the funnel, if not connected with the receptacle which receives the gasoline or with the ground, becomes electrically charged. If the gasoline is caught in a tin can which stands on a sheet of glass, and wires connected to the funnel and receiver, a spark can be obtained when the wires are brought together. The length of the spark depends upon the conductivity of the air, which is least on dry, cold days.

In running gasoline into the tank of a car through a strainer of chamois or other similar material, care should be taken that the funnel is not insulated from the tank by a surface coated with varnish or other nonconductor. If metallic connection between funnel and tank cannot be made directly, both should be grounded.

Brunswick, Me. MARSHALL P. CRAM.

Some Suggestions About the War

To the Editor of the SCIENTIFIC AMERICAN:

No doubt a great number of SCIENTIFIC AMERICAN readers must have been puzzled by the statement made in the European news that the Germans at the head of the river Seille caused an inundation below. Also a similar statement concerning the Yser, made recently.

While several of the French rivers are of a fair size, quite a number are nothing but mere creeks. Nevertheless, they are navigable, having been "canalized." That is, dams provided with locks have been built across them close enough together to form ponds of slack water of sufficient depth. The river thus becomes a succession of ponds, or small lakes, separated by the dams. It is easy to see that by opening both gates of a lock the water impounded behind will rush through with tremendous force. If, after it is well started, the next one below is opened, then a little later a third, and perhaps more, an enormous quantity of water will be turned loose and flood the regions below.

Another thing: after the German guns demolished several of the Belgian and French forts, every military "expert," or would-be expert, declared that the time of fortifications is passed forever. I hope it is, but I do not see any reason for taking that ground. The whole thing is simply this: the German guns were much larger and reached much farther than those of the forts. If the guns of the forts had had an equal or greater range, their fire would have made the setting of the German guns absolutely impossible.

As to which can ultimately use the largest gun, I say that it is the forts, or any other kind of permanent fortification, because it is possible to secure foundations of any desired strength. With movable guns, it is not possible to establish a concrete foundation beyond a certain size, even if it could be done without being subject to the fortress' fire. Then the difficulty of transportation will limit the size of a movable gun to a point far below that of a permanent arrangement. The walls and roofs of the forts were not calculated to resist projectiles of the size used, but their strength might be considerably increased. ADRIAN GETAZ.

Knoxville, Tenn.

The Optophone and Musical Pitch

To the Editor of the SCIENTIFIC AMERICAN:

Some time ago I wrote you about the optophone in reference to the height of the letters used. Since then I have seen a better description in which they claim the optophone will read any size of type. They do not require raised or embossed letters. There is one thing about the apparatus I do not understand, viz., why do they use a right-angle prism? Why not place the Nernst lamp and the siren disk in a vertical line with the portrait lens and save the waste of light caused by the prism?

As you will see in the article, he perforates the siren disk with many holes arranged in eight concentric circles. The holes in the inner circle break the light to correspond to the note *g* of the musical scale. I have arranged the tuning he uses in the following table, placing *g* the lowest in pitch below:

e''	651.762	e'	325.881
c''	517.305	d'	290.327
b'	488.270	c'	258.652
g'	387.540	g	193.77

The figures and decimal fraction represent the double vibrations per second, according to the Standard International pitch in which a' has 435 double vibrations per second and c'', the octave above middle c', has 517.3.

The article about the optophone is in the *Proceedings* of the Royal Society, Vol. 90, No. A 619, p. 373.

Do you not think that an expert in reading from the optophone in a short time would stop spelling the words letter by letter and read the characteristic sound of each word? E. H. HAWLEY,

Custodian, Section of Musical Instruments, Smithsonian Institution.

P.S.—I append a table of the vibrations of each letter of the musical scale from below middle C to C the octave above computed with the geometrical ratio 1.05946309435. The only whole number in the scale is a' 435. I give *a* the octave below to show how small the error is in the computation. I have not seen similar totals carried out much farther than three decimals. I use the above ratio to determine the positions of frets the length of horn and organ pipe the positions of lateral openings in wind instruments.—E. H. H.

The International Standard Pitch.

COMPUTED TO THE ELEVENTH DECIMAL FROM A′, HAVING 435 DOUBLE VIBRATIONS PER SECOND.

The international standard pitch has an equal tempered scale composed of 12 semitones, the number of vibrations of any letter, and the same letter an octave above the letter is double that of the first, and the geometrical ratio from any semitone of the scale to the next is that number which multiplied by itself and its product by the same multiplier twelve times the result should be two, in other words the 12th root of two, which I have worked out to the 11th decimal, getting 1.05946309435. The ratio

c''	517.30509506692	c'	325.88178923494
b'	488.27097105730	$d\flat'$	307.59144982330
$a\sharp'$	460.86644609066	d'	290.32766829977
a'	435.00000000000	$c\sharp'$	274.03282837132
$g\sharp'$	410.38532602013	c'	258.65254753346
g'	387.54094239783	b	244.13548552865
$f\sharp'$	365.78904064497	$a\sharp$	230.43222304533
f'	345.25972881517	a	217.50000002288

c', the fourth letter from the bottom, is middle *c*, the beginning of the once marked octave which extends to *b* above. The letters below c' are of the unmarked octave; c'' upper letter is the first of the twice marked octave. a' is the beginning of the computation of its number of double vibrations, 435 multiplied by the ratio above gives the semitone $a\sharp$ above with 460.866 vibrations. This product again multiplied by the same ratio gives the vibrations for the next semitone b', and so on. The semitones below a' are obtained by dividing 435 by the ratio, its quotient being used as a dividend for the second semitone below, and so on. E. H. HAWLEY.

Torpedo Attack from the Air

IF the modern automobile torpedo can only thrust its nose against the side of a warship, that ship ceases to exist as a fighting unit of the fleet; instantly it is put out of action, and probably it will go to the bottom. The blow of a single modern torpedo, carrying from 200 to 300 pounds of explosive in its warhead, can send any one of the older warships to the bottom in quick time, as witness the loss of the "Aboukir," "Cressy," and "Hogue"; and it is pretty well certain that the blow of two torpedoes would do the same for the most modern dreadnought.

That the torpedo will cripple or sink the enemy, if it once gets home, is an absolute certainty; but the great problem is to bring the gun-platform from which the torpedo is fired sufficiently close to the target to make sure of this overwhelmingly destructive weapon hitting the mark.

As matters now stand, there are three methods of bringing the torpedo within hitting range—the hitting range in the most powerful modern torpedoes being 10,000 yards. First, they may be fired from battleship-cruisers and other large surface vessels through under-water tubes; second, they may be fired from tubes carried upon the decks of torpedo-boat destroyers; and third, they may be fired from submarines. Aimed attack from under-water tubes on large warships is not likely to be very effective, for the reason that such ships will fight at long ranges, which, in the case of armored vessels, will probably be from 8,000 to 10,000 yards. Torpedo attack from destroyers must also, usually, be carried out at considerable ranges—this for the reason that the anti-torpedo, rapid-fire battery can concentrate such an overwhelming fire that the chances of the destroyers getting within point-blank range, at least in the daytime, are very remote. Torpedo attack from submarines is not limited to distant ranges; since it is possible for a submarine to approach, undetected, within a few hundred yards of its prey. The limitations of submarine attacks are due to the slow speed, both on the surface and submerged, of the submarine as compared with the ship attacked. At the surface the submarine must keep outside of the range of torpedo-defense guns, and, if it submerges, it at once becomes blind and its slow speed renders it very improbable that it can get within striking distance of an enemy that is moving rapidly.

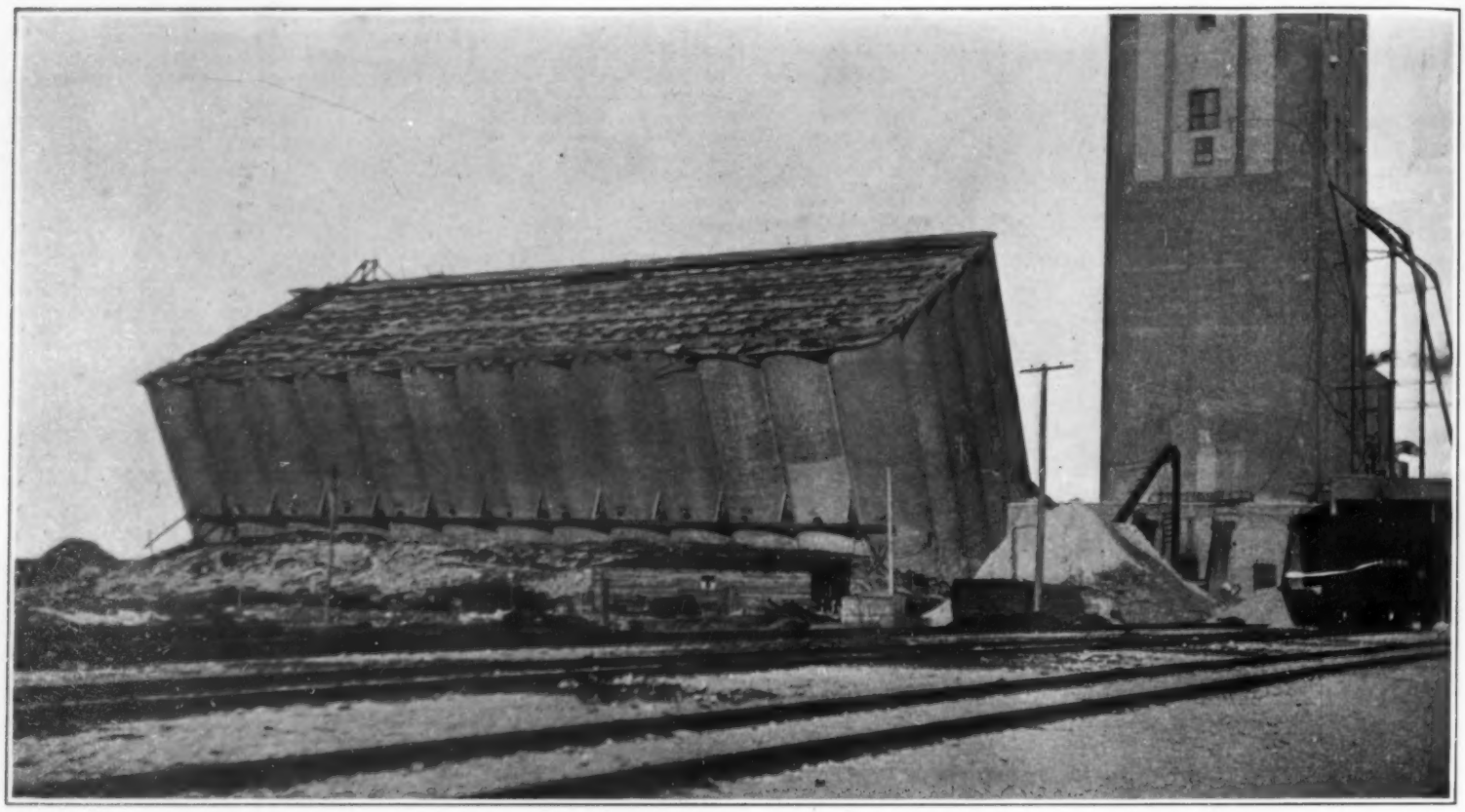
To render torpedo attack absolutely effective, the torpedoes should be launched at a distance of between 1,500 and 2,000 yards, at which ranges the torpedo officer can estimate the speed of the ship aimed at so closely that the torpedo with its high speed of 35 to 40 knots is certain of finding its quarry.

The problem of delivering torpedo attack at this close range has been worked out along novel and promising lines by Admiral Bradley A. Fiske of our Navy, who has conceived the bold idea of using a swift and powerful aeroplane for bringing the torpedo within the point-blank zone of fire and delivering the attack at distances which will make a hit inevitable. Fiske's method, as illustrated on the colored cover of this issue, is to attach the torpedo below the body of the aeroplane in such a way that its axis will coincide with the longitudinal axis of the machine. The attachment is such that the airman, by pulling a lever, can release the torpedo at the moment when it is aligned on the proper course to make a hit. Once it has dropped into the water, its automatic mechanism will submerge it to the required depth of about fifteen feet and steer it unerringly to the target.

In making the attack, the aeroplane would rise to an altitude of from 2,000 to 2,500 feet, and approach until it was within striking distance, when it would descend in a sharp spiral within a short distance of the water. The airman would now steady his machine for an instant, until it and its torpedo were pointing on the true line of fire, when the attack would be delivered by the simple pulling of the lever above mentioned.

The preferred time of attack would be on a clear night on which the dark mass of the ship to be attacked would be plainly discernible from above. The chances of discovery by the searchlights of an enemy before the aeroplane was within firing distance would be remote; and even in case of discovery, it would be difficult for the ship's guns to hit a fast-flying machine that was descending in rapid spirals of small diameter.

Shackleton's Plans Upset.—When Sir Ernest Shackleton left Buenos Aires last October on his Antarctic expedition it was arranged that he would proceed in the "Endurance" and that another section of the expedition on the "Aurora" would go to the Ross Sea, on the New Zealand side of the Antarctic, where the two divisions would meet in April, 1915, or at latest in March, 1916. It appears now from reports from Sydney, N. S. W., that a strike in the dockyards has delayed the departure of the "Aurora," thus entirely upsetting all plans, and that it will not be possible for Sir Ernest to start on his transantarctic journey until next year.



The foundations of this 1,000,000 bushel grain elevator failed on one side, allowing it to lean over to an angle of 30 degrees.

Righting a Twenty-thousand-ton Grain Elevator

A Novel Engineering Feat Performed on a Big Concrete Building

A REMARKABLE piece of engineering work has recently been successfully accomplished near Winnipeg, Manitoba, in straightening up and replacing in position an immense grain elevator which had settled on one side to so great an extent that it was in serious danger of overturning altogether.

This elevator, which consisted of sixty-five great circular bins, each 80 feet high, constructed of reinforced concrete, belongs to the Canadian Pacific Railway and is located at North Transcona, eight miles from Winnipeg, which is an important shipping point where great quantities of grain from the vast wheat fields of the region are handled.

The bins have a combined capacity of 1,000,000 bushels and are estimated to weigh about 20,000 tons. Owing to unforeseen conditions that developed in the subsoil beneath the structure the great block of tanks, which were tied together by the reinforced construction into a single unit, began to settle on one side, and before any adequate preventive work could be applied it had settled so far as to bury the low side of the structure to a depth of about forty feet in the ground, leaning over at an angle of about thirty degrees from the perpendicular.

There was a considerable quantity of grain stored in the bins at the time and this was removed as quickly as possible by cutting the openings in the sides of the bins, which can be seen in one of the accompanying illustrations. This was done both to save the grain and to remove as much weight from the structure as possible. At the same time heavy shoring was put in place to prevent further settling.

The next question was what could be done to save the structure, which was a new and expensive outfit that was badly needed in the business of the railway. The loose nature of the soil, however, added to the difficulties, and after considering a variety of plans a contract was given to a Montreal firm that has successfully accomplished its undertaking.

On account of the great weight of the structure and the surrounding conditions it was not considered feasible to jack it up into its original position, and another and simpler plan, which was also considered to be much safer, was adopted. But before any replacement could be undertaken it was necessary to prepare an entirely new and secure foundation, for the old foundations had proved to be entirely inadequate.

After shoring up the structure as securely as possible the contractors began work on the high side of the building by driving a series of tunnels under it at intervals of fifteen feet. As these progressed additional shoring was put in, as it would be unsafe to reduce the supporting area to any extent.

From these tunnels pier excavations were sunk to bed rock at frequent intervals, a distance varying from forty to fifty feet, and, in addition, a number of shoring piers were also constructed. Most of these foundation piers were about six feet in diameter and were of heavy reinforced concrete. Altogether seventy piers will be required for the new foundations. The material removed in driving the tunnels and sinking the foundation piers was carried out by belt conveyers, as the available working space was greatly restricted by the necessity for elaborate shoring and many heavy steel supporting girders upon which the weight of the structure was carried during the underpinning operations, and which were subsequently utilized in the operation of straightening up the building.

The operation of returning the structure to a perpendicular position is not the ordinary one of simply jacking up the low side, but is rather what may be termed a process of rolling. That is, what may be termed a longitudinal axis is established somewhat to the low side of the center longitudinal line of the building, and while the low side is jacked up the high side is correspondingly lowered. The result of this process will be to right the structure, but on the completion of the operation it will rest at a lower level than that on which it originally stood. This result appeared unavoidable, as it was considered neither safe nor possible, considering the size and weight of the structure and the character of the soil beneath and surrounding it, to attempt to both right and replace it in its original location. However, this new location will not seriously interfere with its future use, as it only necessitates some modifications of the grades of the subway tracks and the connections with the adjoining machinery building.

Rolling a large and heavy mass like this nest of bins is a most delicate operation, for its movement must be under perfect control at all times. So, besides the powerful screw lifting jacks under the lower side, it was necessary to arrange another series of jacks and shoring under the high side, so arranged that the supports on this side could be gradually relaxed as pressure was applied on the other side of the building. Arrangements also had to be made for the gradual and systematic withdrawal of the earth that was left between the tunnels that were driven under the building from the high side for the construction of the new foundations.

The great reinforced concrete elevator near Winnipeg as it now appears after having been rolled back into an upright position.

Fortunately the failure of the foundation did not extend to the large building adjoining the grain storage bins, which contains the power plant together with the elevating, handling, weighing and grain-cleaning machinery, and this was fortunate, as a similar settlement would undoubtedly have wrecked the mechanical outfit. Still, the foundations of this building were considerably weakened and could not be relied upon permanently.

In order to make good these defects extensive new foundation work was placed under the machinery building, which is about 180 feet high, and this included the construction of forty-four concrete piers extending down to bed rock and the necessary work for transferring the weight of the building to these new sup-

ports. Taken altogether, it has been a most delicate and ingenious engineering feat which has saved for its owners a valuable and necessary plant.

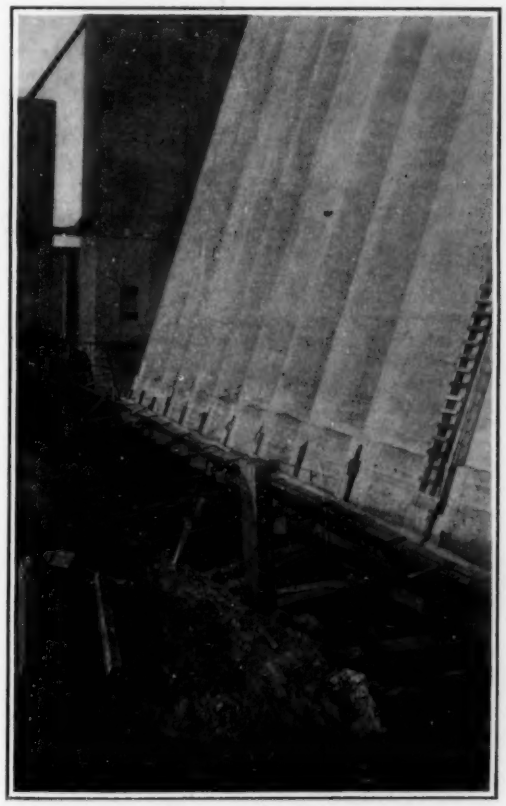
Powerful Motor Tractors

ONE of the most important branches of the motor vehicle field, and the one that is rapidly becoming dominant in the industry, is the commercial vehicle. Of this class an important subdivision is the tractor for heavy hauling, and these are not only most valuable for many kinds of work on the farm—indeed large modern farms could not be operated without them—but just at present the reports from abroad of the feats performed in hauling heavy guns emphasize their importance. Steam-powered tractors have been extensively employed for years, but the improvement in internal combustion engines has greatly stimulated the industry and tended to the development of many details, so that the gasoline or oil tractor of to-day is a remarkably efficient production. One of the most important parts of farm work is plowing, and for this great tractive power is required, and it is of advantage if this can be secured without letting the machine sink deeply into the earth on the one hand, or compact the earth too much on the other; and this result could be secured when ordinary wheels are used only by making them excessively large and wide, which is frequently not permissible. With a view to overcoming the difficulties inherent in the ordinary wheel various devices have been produced, but one of the most successful has proved to be the "caterpillar" system which appears to give unlimited traction, and will work over very soft ground without sinking in, and when plowing it does not seriously compact the soil. In this arrangement there are two driving wheels on either side of the machine about five feet apart, and running on them as pulleys is a wide belt of steel plate links, with a projecting gripping arrangement on the face of each link to give a hold on the ground.

In a demonstration this fall a tractor of this description, having a six-cylinder internal combustion motor with 7¾ by 8-inch cylinders, and having a tractor belt 2 feet wide, pulled twenty-four plows, turning furrows 14 inches wide and 7 to 8 deep in hard, dry soil. This outfit turned over a strip 28 feet wide at a speed of 2⅛ miles an hour, or at the rate of 7¼ acres; and it is estimated that the draw-bar pull equaled 80 per cent of the weight of the tractor, which is far in excess of what can be obtained by any other haulage system.

Oven Temperatures

IN a bulletin of the New York Teachers' College, Miss M. B. van Arsdale urges the more general use of oven-thermometers in the kitchen and the introduction of definite specifications of temperature in place of the vague descriptions that now generally accompany recipes. She also gives the results of a number of experiments on the relation of time and oven temperatures to the cooking of various kinds of foods. The following classification of oven temperatures is suggested: Low temperature (250-350 degrees), custards, meringues; low to moderate, sponge cake, angel food; moderate (350-400 degrees), bread, gingerbread, plain cake, cookies; hot or "quick" (400-450 degrees), Parker House rolls; hot to very hot, baking powder biscuit. Pastry (pies) begins at 500 degrees, finishes at 450 degrees.



The elaborate shoring at the high side of the Canadian Pacific grain elevator for supporting and controlling its weight while new foundations were being placed underneath.

$500 Prize for "Made in the U. S. A." Trade-mark

THE idea is springing up in various localities to adopt a "Made in the U. S. A." trade-mark, not only to meet the requirements of some foreign countries in regard to the marking of imported goods, but for the further purpose of impressing upon our own people, some of whom buy foreign products simply because they are "imported," that American-made goods are fully the equal of any we have been getting abroad. In adopting this idea the Detroit Board of Commerce hopes to inaugurate something of a national movement, and for this purpose it is offering a prize of $500 for the best design for such a mark. This design, which must conform to the regulations contained in the U. S. Trade-mark laws, is to include the words "Made in Detroit, U. S. A.," but must be national in its character and such that it can be appropriately adopted by any other city, and the space occupied by the name of the city must be so arranged that any other city may be easily substituted.

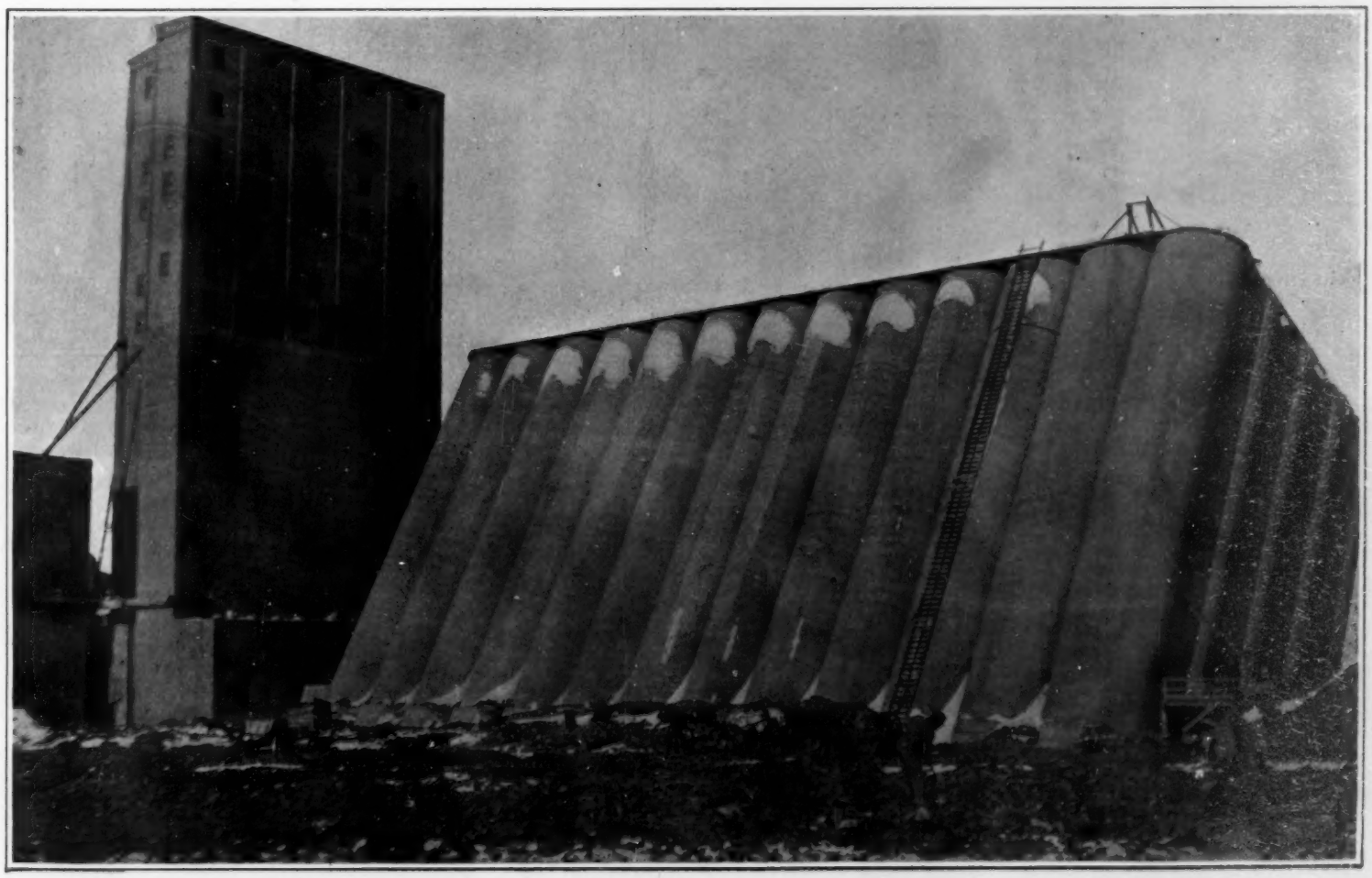
After the selection of the design it is the intention of the Detroit Board of Commerce to offer it to other boards, National Association of Manufacturers and other similar associations, with a view to making the movement national in its scope and to induce manufacturers to adopt a uniform design that shall represent the entire country.

This prize competition will close on February 25th and all artists desiring to enter can obtain copies of the rules of the contest by addressing the Chairman of the Made in America Committee, Detroit Board of Commerce, Detroit, Mich.

To Our Subscribers

WE are at the close of another year—the seventieth of the SCIENTIFIC AMERICAN's life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year.

To those who are not familiar with the SCIENTIFIC AMERICAN SUPPLEMENT a word may not be out of place. The SCIENTIFIC AMERICAN SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.



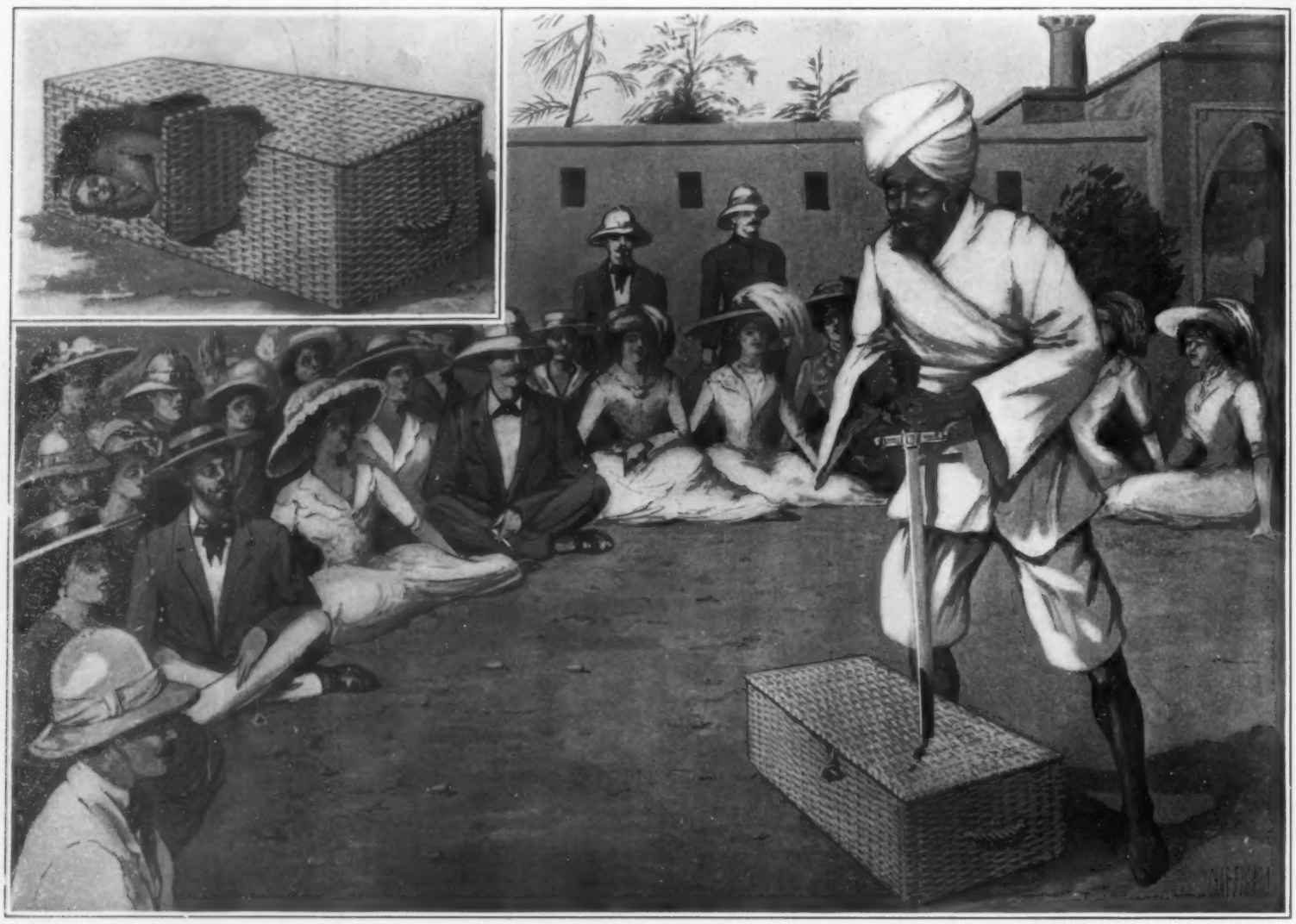
View of the great reinforced concrete grain bins, weighing 20,000 tons, which have been successfully restored to an upright position.

The Methods of Hindu Jugglery and Magic

The Indian Basket Trick

By Prince Sarath Ghosh, F.R.A.S.

THERE has been greater misunderstanding about Hindu jugglery than about any other Oriental institution, practice, or body of knowledge. The scores of writers, European or American, who have essayed to elucidate the subject have only succeeded in casting a veil of obscurity around it, by each contradicting the others or themselves unwittingly. Each started with a preconceived notion, a pet hypothesis, and tried to fit the facts to it. Some sought to find mysticism in it, and found it. Some sought for pure trickery, and found it; some, finding all other methods futile, denied everything, even the facts; some others, more daring, invented the facts. In reality the truth about Hindu jugglery or magic, or call it what we will, is very simple; it is the explanation that is supremely difficult.



The Indian basket trick. Withdrawing the bloody sword. The insert shows the mechanism of the trick.

The once famous basket trick of India is also now copied on the European stage with a cartload of paraphernalia and hidden appliances. The Hindu juggler brought for this trick only a basket, necessarily a large one, a sword, and a little girl. The two or three assistants who also came had no obvious purpose; they merely sang and "made music." The juggler calls the girl, who is very prettily dressed in distinctive colors, and starts to quizzing her.

"Arré, thou incarnation of mischief, be still—do not fidget! What an upturned nose thou hast, and large mouth, and receding chin," thus pointing out all her characteristic features. "Go to that nice gentleman and talk to him a moment; he will give thee a present if thou dost this trick without a fault." All that is meant to enable the spectators to scrutinize her and identify her afterwards.

Then the juggler brings out the basket; it is about three feet long, two wide, and two deep; its lid opens along its length. He raises the lid and turns the basket on its front edge to show the spectators that it is empty; to make quite sure he turns down the face of the basket to the ground and beats the bottom with the flat of his sword. Leaving the basket there, he goes to the child, who is still talking to the spectators. But with a sudden shriek of terror she runs round and round the arena—of course in full view of the spectators. The juggler chases her and nearly catches her. With redoubled effort she dives hither and thither to dodge him. At last exhausted, she suddenly dives behind the musicians, but the next instant the juggler swoops down on her, stands over her a moment, shaking her and upbraiding her. Then he snatches her up and carries her struggling in his arms to the basket. Kicking up the basket with his foot to its normal side, he pushes her in. Banging down the lid, he thrusts down the sword through the middle of the basket as far as it will go. There is a shriek from the inside. The juggler withdraws the sword, covered with blood, and thrusts it again and again along the longitudinal line of the middle of the basket; the child shrieks at each thrust, but fainter and fainter. At last the shrieks die away. The juggler stands a moment amid the oppressive stillness. Then suddenly he opens the lid, turns up the basket to the spectators along its front edge, shows it blood-smeared but empty; and to make quite sure, he turns down the face of the basket to the ground quickly and beats the bottom with the flat of the sword, as before. Then a sudden remorse seizes him.

"Oh, what have I done, what have I done! I have killed my child! I have sent her soul wandering through space, awaiting nirvana." He looks hither and thither in despair.

Suddenly a small treble voice from a distance answers him: "I am here!" The spectators look around, but see nothing. "Where, my child?" the juggler cries. The voice comes again, near and nearer. At last a small figure, draped in a cloak from head to foot, emerges from the back of the spectators—where least expected—and comes to the center of the arena. The figure drops the cloak and stands in full view of the public. It is the missing girl. "Go and show thyself to that nice gentleman and receive thy present," the juggler says to her from a distance without going near her, till the spectators have satisfied themselves she is the same girl. Meanwhile the basket and the cloak have been removed by the assistants.

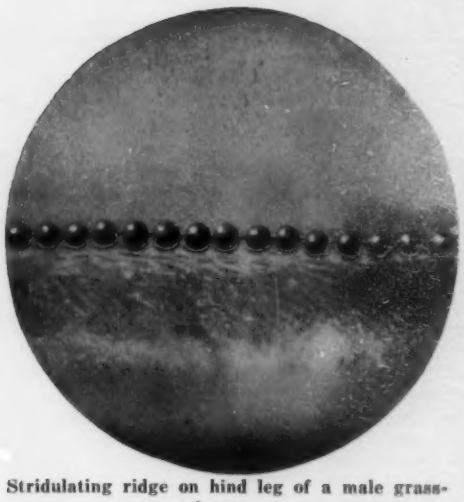
Here is the explanation. The removal of the basket and the cloak by the assistants implies that there is something to hide. But the juggler himself might do that while the spectators are examining the girl. Hence, the assistants are not really needed to remove the basket and the cloak; and "making music" is also superfluous for the trick. Thus the assistants are there for another purpose! That supplies the secret! There is *another girl!* She need not be like the first girl, except only in size and in details of dress. While the first girl is being shown round before the trick and the spectators are all intent on scrutinizing her, the second girl—who is dressed exactly like the first, but is covered with a cloak—comes quietly from the back and huddles down behind the musicians. If by any chance anyone has noticed her while coming, it is immaterial; her face being different and her dress unseen beneath the cloak, nobody would anticipate her possible connection with the trick or even with the party of jugglers.

Then when the first girl is chased by the juggler round the arena and she dives at last behind the musicians, and the juggler seemingly stands over her, shakes her and upbraids her, in reality he flings the cloak from the adjacent second girl onto the first and snatches up the second girl and thrusts her into the basket; and as she struggles in his arms the spectators fail to see, in the brief instant, that she is a different girl. Meanwhile, as the stabbing of the basket is going on and the spectators are intent on watching it in horror, the first girl, now enveloped in the cloak, slips out, makes a detour, and waits at the back of the spectators till she

(Concluded on page 532.)

File-like vein or nervure of cricket's wing, greatly magnified.

The muscular sound-producing "drum" of a male cicada.



Stridulating ridge on hind leg of a male grasshopper.

The "Ears" and Sound-Producing Mechanisms of Insects

Curious Substitutes for Vocal Organs

By Harold Bastin

WHILE it is a fact that insects have no vocal organs, in the strict sense of the term, many species are nevertheless capable of producing loud sounds. Probably the most noisy of all insects are the cicadas, commonly called "locusts." Their resounding hum may be heard each year during the height of summer; but to appreciate fully the sound-producing mechanisms of cicadas one must needs visit the tropics. In Brazil, for example, a very large species gives a sort of scream that is astonishingly loud.

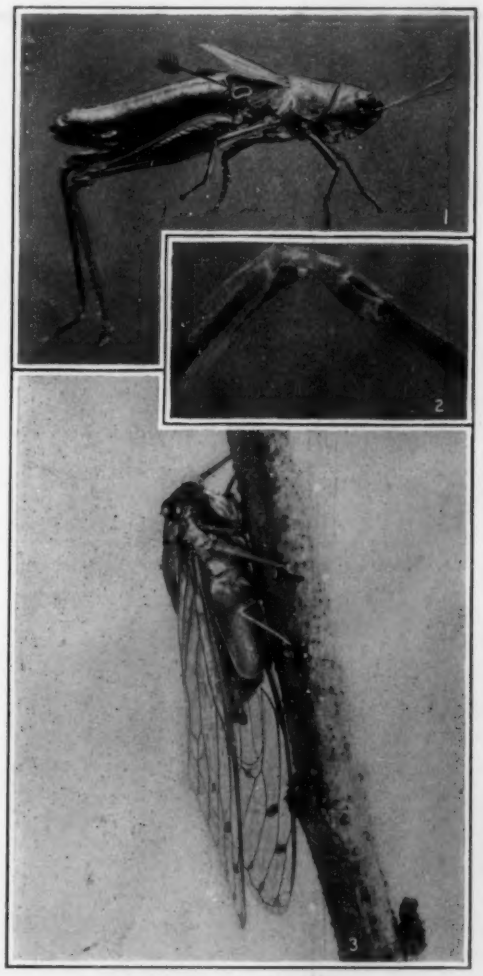
If we examine the under surface of a male cicada we shall find two plates which spring from the metathorax (i. e., the hindmost of the three thoracic segments) and overlap the abdomen to a greater or less extent. Beneath each plate, or operculum, there is a cavity which contains the sound-producing mechanism. The most noticeable organ is a membrane, or drum, to which a muscle is attached. It is to the rapid vibration of this drum that the so-called "song" of the cicada is primarily due, although other membranes within the cavity are probably also agitated, while the whole skeleton of the insect, including the opercula, presumably helps to increase or modify the sound.

Apart from the cicadas most other insects that produce sounds do so by virtue of a "stridulating apparatus." In other words, one part of the body is rubbed against another part, much as the bow is rubbed across the strings of a violin. For example, the chirping of short-horned grasshoppers, or *Locustidæ* (the *Acridiidæ* of many authors) is produced by rubbing the thigh or femur of the hind leg against the fore wing, or tegmen. On the inner side of each hind femur there is a ridge surmounted by a row of minute tubercles—really modified hairs. These are rubbed against a prominent vein on the tegmen, and a shrill sound is produced. So far as is known, only the smaller kinds of grasshoppers possess this musical apparatus; the larger species of the family are apparently quite silent.

It is scarcely necessary to remind the reader that the crickets and long-horned grasshoppers (including the well-known "katydids") are extremely tuneful insects. In both these families the sound is due to the structure and movement of the tegmina, unassisted by the legs. There is, however, a difference in detail. In crickets (*Gryllidæ*) the tegmina of the males are nearly alike, the right one being commonly, though not invariably, uppermost. Each tegmen has a file-like vein, or nervure, on its lower aspect. With the file, the insect rasps a prominent ridge on the upper aspect of the tegmen which lies below. In long-horned grasshoppers (*Phasgonuridæ*), however, only the left tegmen (which is invariably uppermost when the insect is at rest) is furnished with a file-like vein. It should be added that in both these families the tegmina are often remarkably modified, doubtless with the object of increasing the sound volume.

With respect to the origin of sound-producing mechanisms among insects most naturalists argue that they are the outcome of long-continued sexual selection. It is believed that the "song" is a kind of courtship accomplishment, calculated to excite amorous propensities in members of the opposite sex. The fact that, with few exceptions, only male insects are gifted with powers of "self-expression" is significant, and accords well with what we know concerning the habits of birds; nor are direct observations lacking to complete the weight of evidence. Harrington, for example, writing of a species of cricket, says: "While the male is energetically shuffling together its wings, raised almost vertically, the female may be seen standing just behind him, and with her head applied to the base of the wings, and getting the benefit of every note produced."

The fact that many insects are able to produce sounds leads us, not unnaturally, to conclude that they are able also to hear. But in general it has proved very difficult to demonstrate in these creatures any structures that can, with certainty, be regarded as "ears"—that is to say, as specialized auditory organs. For example, among cicadas—a family which admittedly includes the most noisy of all insects—science has completely failed in her efforts to discover any organ of the kind. This has given rise to no little speculation, and more than one ambiguous theory has been advanced. Certain naturalists, among them Girard, are of opinion that cicadas do not hear in our sense of the word, but "feel rhythmical vibrations." One is inclined to regard this as a distinction without a difference! Again, Swinton claims that one of the membranes connected with the sound-producing mechanism is auditory in function; but if this is so, as Dr. David Sharp remarks, "the male would be deafened by his own noise, while the females, not possessing the organ, should not hear the song."



The ears of insects.

1. Young grasshopper with wing rudiments pulled back to show the "ear." 2. In the long-horned grasshoppers the external opening of the ear is in the shin. 3. Male cicada at rest. The plate-like cover, or operculum, of its right sound-producing organ is plainly visible. Swinton claims that one of the membranes beneath the operculum is auditory in function.

It is a fact that the sense mechanism of an insect includes vast numbers of minute "nerve endings" which, through microscopic pores in the chitinous exoskeleton, communicate with the centers of perception. The precise functions of these nerve endings, even when their character has received careful investigation, is usually difficult to determine. But we are not without evidence to justify the assumption that while it is often tactile or olfactory it is sometimes auditory. We are free to believe, in fine, that cicadas—and possibly insects of many other kinds—are gifted with a generalized faculty for receiving sound vibrations; and that in this sense they may be said to "hear," notwithstanding the fact that specialized auditory organs are absent.

With certain insects—notably the grasshoppers, crickets, and their allies—the case is quite different. Here we find definite ear-like organs, admirably adapted for the reception and transmission of sound waves. Briefly, there is a tympanum, or "drum," with a complex arrangement of nerve, muscles, and tracheal tubes. These organs are paired, but their external openings are not in the head—as is the case with those of the ears of vertebrate animals. The "ears" of a meadow grasshopper, for example, are to be found in the first abdominal segment, the openings being immediately above the articulations of the hind legs. Similar auditory organs have their place in the fore shins, or tibiæ, of crickets, as well as of long-horned or tree-frequenting grasshoppers; while Folsom states that structures, presumably analogous in function, are found on the tibiæ of ants, termites, and stone-flies (*Perlidæ*); on the femora (*thighs*) of lice (*Pediculidæ*); and on the tarsi (feet) of some beetles (*Coleoptera*).

Many species of flies (*Diptera*) possess organs whose general structure resembles that which has been described above. In the blow-fly, for example, Lowne describes a circular "drum" in connection with air-spaces and nerve-endings—the whole being situated in a cavity beneath the base of the wing; while above this drum, under the scutellum, is a supra-tympanal organ, like that of a long-horned grasshopper.

According to Child, a very beautiful "ear" is found in the second antennal joint of many insects—the organ being most perfectly developed in the males of certain mosquitoes and midges. The joint in question is greatly swollen and cup-shaped; and although in the females of these insects a similar structure is present, it is far less perfectly developed. From this it is natural to assume that the male mosquito relies chiefly upon his sense of hearing when seeking a mate; and, indeed, it has been shown that the minute lateral hairs on the shafts of the insect's antennæ vibrate to the note produced by the female's humming flight, and that they do so most strongly when the sound waves strike them at right angles—that is to say, when the tips of the antennæ point in the direction from which the sound comes. The male, therefore, must be able to estimate very exactly the whereabouts of the female.

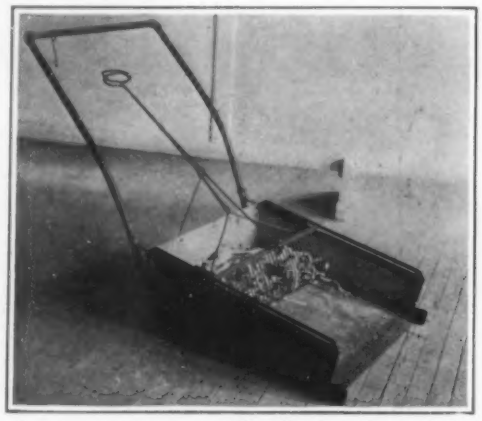
Inventions New and Interesting

Simple Patent Law: Patent Office News: Notes on Trademarks

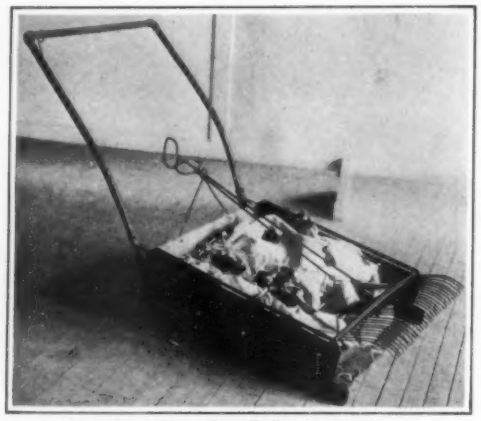
The Inventors' Show at New York

THE Exhibition of Inventions at the Grand Central Palace in New York, held December 12th to 19th, while quite modest in its proportions and far from spectacular in its setting, contained many points of interest to practical people, and this was the notable characteristic of the show, that it was essentially practical, for the majority of the inventors who exhibited their ideas had devoted their efforts to everyday affairs and needs. One of the most prominent lines of invention shown related to railroads, and several forms of metallic ties were shown, as well as an ingenious renewable rail head. Another apparently practical device that appealed to the visitors was a "portable trip," for stopping trains in case of accident. A number of roads are equipped with an apparatus by which the brakes of a train can be applied by the operator in a signal tower, and consists of a pendent lever on the train connected with the brake apparatus, which comes into contact with an arm that the signal operator can throw into contact position when necessary, thus enforcing the stopping of the train should the engineman fail to see an adverse signal; but this arrangement can now only be applied at the signal tower, and it occurred to Charles F. Peel, an experienced railroad man, to produce a portable trip that a flagman, sent back to protect a standing train, could take with him, and by placing it on the track make certain the stopping of a following train, even if his flag was not seen on account of fog or darkness. It would also be valuable in protecting workmen on the tracks. The device, which is shown in an illustration, is simple, and easily carried, and as that is secured in place only by a spring it is but the work of an instant to snap it onto a rail anywhere. It appears to provide against a class of accidents that have been painfully frequent.

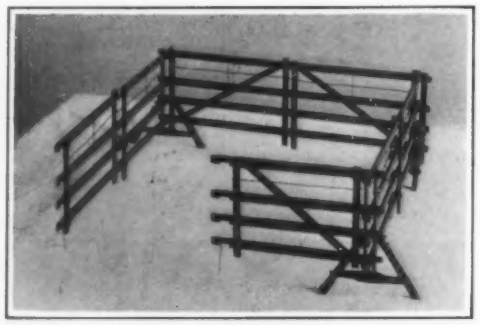
Farmers are not usually supposed to be inventors, but George G. Bates has produced a new kind of hay wagon that he claims to have saved him a great deal of time and labor. When a mechanical loader is used two men are kept busy passing the hay forward from the delivery point at the rear, and frequently when unloading this work has to be repeated. In the new automatic rack a track with small rollers is located on the usual platform, and on this is mounted a light supplementary rack half the length of the main rack. When the loading commences this supplementary rack is placed at the rear end of the main rack, and the loader delivers the hay directly onto it, where one man easily treads and distributes it. When this short rack is full the operator pulls a cord which couples up a gearing connecting the supplementary rack with the rear wheels of the wagon, with the result that the loaded rack is run to the front end of the main rack without stopping the team, carrying with it the half load of hay that has been taken on; and the loader continues depositing hay on the now empty rear half of the main rack, thus completing the entire load with practically no hand work. When unloading, the same operation can often be taken advantage of with a considerable saving of labor and time.



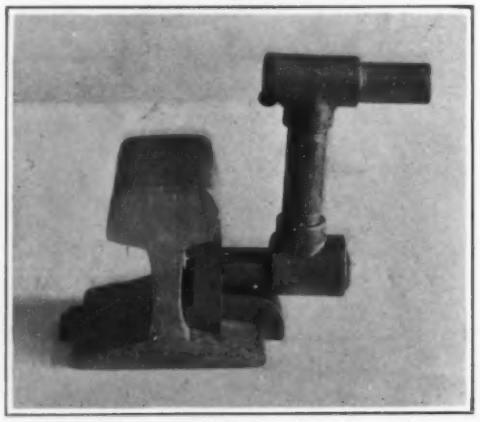
A new street scraper with collections drawn back.



Operating the rake of the street scraper.



Handy portable farm fence.



Portable air-brake trip for preventing railway accidents.

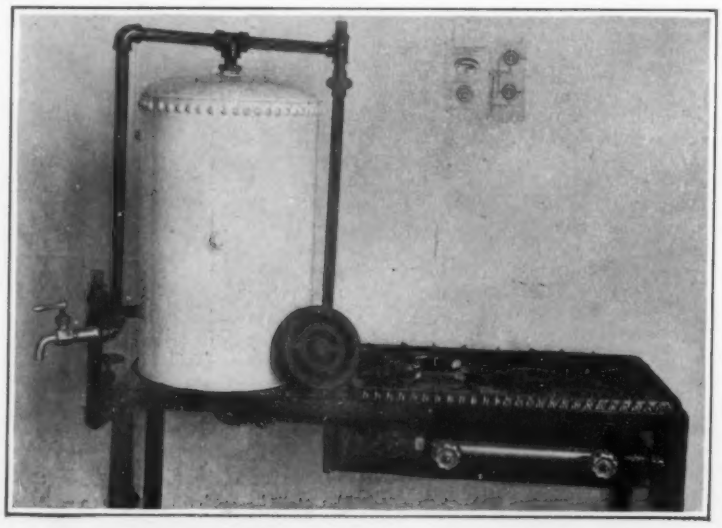
Another handy farm device is the Davis portable fence. Almost any farmer who keeps cattle or small animals finds frequent occasion to limit them to some portion of a grazing ground, or to pen a portion of them for some purpose for a time; and in such cases it is customary to run up a temporary fence. Even when light in character this entails considerable work, and the portable fence in question meets the conditions effectively at a reasonable cost. It is built in sections that can be coupled together in any combination desired as fast as the panels can be handled, as each panel is a permanent structure complete in itself.

Few things are more irritating and offensive than an untidy street or road, and with the increasing interest in good roads more attention is being given to the care of the same. Anything that facilitates a piece of work tends to improve its quality, and with this idea the Gravelle street cleaner has been designed. It is in the form of a wide scraper on wheels for collecting rubbish, with a considerable capacity, so that large areas can be cleared up quickly and the rubbish carried to some convenient dumping point. The scraping edge can be raised or lowered as conditions demand; but a very practical feature is a rake of the full width of the machine which can be raised and moved forward and back as desired. By this means, as rubbish collects on the forward part of the scraper, the rake can be lifted and dropped in front of the collections, which are then drawn back onto the body of the machine for transportation. This scraper can be built in sizes suitable either for hand or horse power.

A new idea for family use is the Frisk no-cost hot-water heater and gas-burner, in which the burner for a gas stove is cast hollow, with a series of passages for circulating water through the body of the burner. By this arrangement, in connection with a tank conveniently placed, a constant supply of hot water is secured at the same time that cooking is being done, without consuming gas specially for this purpose, thus effecting quite an economy of fuel.

Standing of United States Seaports.—Our total foreign trade for 1913, including imports and exports, was four and one quarter billion dollars, and of this amount about two billion dollars was handled through the port of New York. The second seaport is Galveston, which handled $290,000,000 worth of goods. Then follow New Orleans, $252,000,000; Boston, $216,000,000; Philadelphia, $170,000,000; Baltimore, $150,000,000; San Francisco, $130,000,000; Puget Sound ports, $114,000,000; Buffalo, $81,000,000, and Detroit, $71,000,000.

An automatic labor and time saving hayrack.



Burner for cooking and heating water simultaneously.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

CLASP.—NORMA F. SCHAFUSS, 47 Brevoort Place, Brooklyn, N. Y., N. Y. In the present invention the object is the provision of a new and improved clasp, more especially designed for use on hose supporters and like devices, and arranged to securely grip hose or other fabric material without danger of tearing it.

Pertaining to Aviation.

FLYING MACHINE.—J. R. POLIZZI, 1510 N. Dorgenois St., New Orleans, La. The more particular purpose in this case is to improve the stabilizing of the machine while in the air and to facilitate the guiding of the machine up or down. The inventor seeks to promote the safety of the machine in ascending either at the will of the operator or in case of accident.

Electrical Devices.

MOLDING OR CONDUIT FOR ELECTRIC WIRES.—P. ADISON, 10 Cooper Square, New York, N. Y. The invention relates to moldings or conduits for systems of interior and exterior wiring, and more particularly to conduits of that type, consisting of a trough or base section for receiving the wires and a cover section having side flanges that spring or snap over the sides of the trough section.

CIRCUIT INTERRUPTER FOR THERAPEUTICAL APPARATUS.—F. M. KIDDER and M. H. KIDDER, 820 Broadway, New York, N. Y. The invention has for an object the provision of means for regulating the strength of the treating current by adjusting the armature of the interrupter, these being used in connection with the adjusting means a device whereby it is impossible to adjust the armature beyond its vibratory limit, or too close to the pole of the interrupter.

INDUCTION COIL CASING.—H. D. GRINNELL, Agricultural National Bank Building, Pittsfield, Mass. The invention provides a casing which will protect the coils completely from rain or snow. It also provides a casing which is provided with a cover which holds the coil in position without the necessity of locking means, and which can be removed or replaced in a minimum time.

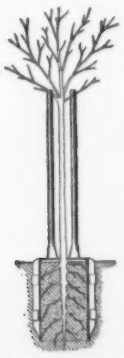
Of Interest to Farmers.

SHOCK BINDER.—P. H. CASEY, care of M. J. Casey, New Richmond, Wis. The object here is to provide a simple and inexpensive device whereby a shock of grain can be quickly and easily tied or untied; and when the shock is tied by means of the device the device cannot loosen itself accidentally, that is, when the shock is handled as is customary.

PEA THRESHER AND HARVESTER.—G. E. PRITCHARD, Lilly, N. C. The machine is adapted to be drawn over the field and provided with suitable guide elements to direct the vines of a row properly to the machine, there being a beater turning transversely, or approximately so, to the direction of travel to strip and thresh the peas, an arrangement of raking elements and forks so disposed and driven as to cause the threshed peas to be delivered rearwardly into a suitable receiving chamber at the rear of the vehicle.

Of General Interest.

TREE BALLING DEVICE.—C. I. HELM, R. F. D., No. 1, Phoenix, Ariz. An object of this invention is to perform with facility the work of digging and balling without disturbing the roots or soil. The various steps of digging the tree and wrapping the same are completed without disturbing the soil around the roots, and the wrapping is applied and secured in

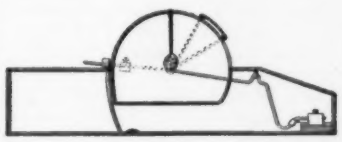


TREE BALLING DEVICE.

a manner to maintain the ball intact until received by the purchaser. The invention is particularly useful in balling such trees as the citrus, fig, date palm, and the like, which are rather costly, and the loss of which by present methods of balling is very great.

SIZING.—J. A. PORTER. Address J. Paul Jones, 211-214 Jefferson County Bank Bldg., Birmingham, Ala. An object here is to provide a sizing which may be applied to a calcimined wall having lime or other alkali, and which will not crack or scale off from the effects of such lime or alkali, but which will have a smooth and uncracked surface.

ANIMAL TRAP.—C. PHILLIPS, Bland, Mo. The invention has reference more particularly to a device comprising a balanced bait compartment adapted to communicate with the bait compartment when an animal enters the



ANIMAL TRAP.

said bait compartment, and whereby the animal in the bait compartment can escape only into the cage compartment. This simple and inexpensive trap is automatic in its action.

BRUSH.—H. C. BROWN, 503 St. John's Place, Brooklyn, New York, N. Y. This invention relates to brushing and scrubbing, and has particular reference to the construction of brush heads whereby such devices are rendered more convenient and serviceable than those commonly employed.

COMPOSITION OF MATTER FOR CLEANING.—E. C. BILTON, 612 W. 115th St., New York, N. Y. The composition of matter is in the form of a thick paint, and consists of an aggregate and a cleansing agent to keep the composition normally in the form of a thick paint, for applying the composition as a coating to the article to be cleaned, to embed the extraneous matter, the coating after drying being capable of cracking and peeling off from the article.

BILGE PUMP.—T. S. BULMER, Greenport, Suffolk Co., N. Y. The purpose here is to provide a simple, inexpensive structure particularly adapted for use upon small boats and embodying a minimum number of readily accessible parts whereby it may be maintained in good working order, easily and at all times.

ARTIFICIAL LIMB.—A. E. TULLIS, Fargo, N. D. The main object in this invention is to provide an air-inflated socket at the stump opening, which is continuous entirely around the said stump, which is readily removable from the limb for repair, substitution, or other reasons.

BOX.—MORRIS J. WHEELER, Box 52, Peterboro, N. H. The body of the box is formed of a single strip formed into a flat coil, with the convolutions one within the other, and in which the inner convolution will have increased height, thereby presenting a neck within the outer convolution to receive the flange of the cover, the exterior of the outer layer and of the flange of the cover being flush, or forming parts of the same cylindrical surface.

VIBRATOR.—L. L. MONTGOMERY, 2509 Oaks St., Superior, Wis. The invention refers to vibrators used for massage purposes, and has reference more particularly to vibrators actuated by elastic fluid. The object of the invention is attained by providing a plunger adapted to be actuated periodically by elastic fluid operable means, with means for returning the plunger to its normal position.

Hardware and Tools.

WRENCH.—I. S. OVERHOLSER, Oakes, S. D. This invention relates to wrenches, and more particularly to that type known as pipe wrenches, and one of the principal objects is to provide a pipe wrench, which may be securely locked on pipes of various sizes by one movement and without the necessity of preadjustment.

DEEP WELL DRILLING TOOL.—C. A. BUTLER, Okmulgee, Okla. Among the objects of the inventor is to so equip a rock drill as to provide for a proper circulation of the fluids surrounding the drill bit so as to prevent the gumming up and sluggish operation of such tool while operating through soft or sticky material.

Heating and Lighting.

HEATING SYSTEM.—F. H. NEUBERGER, Jeffersonville, N. Y. The purpose in this instance is to provide an improved structure in which the smoke and heated gas from the stove or furnace may be utilized for heating purposes through the use of conducting pipes and radiating surfaces over which the smoke and heated gases are adapted to pass.

BRIQUET.—J. ALEXANDER, 11 Ottensener, Markplatz, Altona, Germany. According to the present invention a high-value briquet is produced of a calorific value of about 6,900 heat units, which, as careful tests have shown, can already be produced at a pressure of 100 atmospheres, and which, when burnt on an ordinary grate, will retain its coherence like ordinary mineral coal.

Household Utilities.

KITCHEN UTENSIL.—T. A. BURKE, 203 S. Pearl St., Galesburg, Ill. This invention relates more particularly to an implement adapted for use either as an egg separator, egg beater or cream whipper, the object being to provide a combined utensil of this character which is simple and inexpensive in its structure and highly effective in use.

STOVE LID.—N. E. RICE, Garberville, Cal. This invention has for one of its principal objects the provision of a stove lid by means of which a cooking vessel may be supported out of direct contact with the stove top, and thus scorching or burning of the contents of the vessel may be prevented.

FLY KILLER.—L. W. KARSCHNER, Pikes Creek, Pa. In this invention the device is so constructed and arranged as to be employed either as a swatter or as a trap, means being provided for readily converting the device to adapt it for either use. When arranged as a trap, sticky fly paper is employed in connection with the device.

BEDSTEAD CORNER FASTENER.—W. C. MURRAY, Corry, Pa. The general objects of the invention are to improve and simplify the construction and operation of bedstead joints so as to be reliable and efficient in use, comparatively inexpensive to manufacture, and so designed as to provide a strong and substantial connection between the side bars and corner posts.

PEA SHELLER.—E. MADELINE STEWART, care of J. B. and S. W. Brooks, Boston, Ga. The pea sheller is especially distinguished by an improvement in form, number, and coaction of pairs of rollers between which green pea-pods are passed for feeding them to a knife by which they are slit neatly and expeditiously.

Machines and Mechanical Devices.

UNDERREAMER.—T. S. APGAR, 6 East Side, Robinson, Ill. This tool is especially adapted for underreaming well casings, as, for instance, in gas, oil or other wells, wherein the reaming mechanism may be contracted within a diameter less than that of the interior of the well casing to permit the passage of the tool through the casing, and wherein means is provided for automatically expanding the reaming mechanism when the proper position is reached, and wherein the parts may be again contracted to permit the removal of the tool from the casing.

CLUTCH.—E. H. BUCKLEY, Caledonia, Minn. The invention comprehends a clutch providing a revoluble drum, and with a cable to be wound by the rotation of said drum, a sweep normally connected with the drum for turning the same, and disconnecting mechanism controllable at a distance, and of special construction for rendering certain and positive the disconnection of the sweep.

MECHANICAL MOVEMENT.—S. MESTEL, 92 Catharine St., New York, N. Y. This invention relates to hand operated devices, such as egg beaters, fans and the like. Among the objects is to simplify and improve this class of hand motors whereby they are cheapened in construction and rendered more effective than devices heretofore proposed for the same purpose.

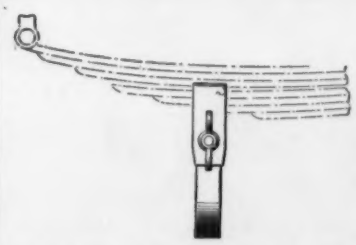
EJECTOR.—J. R. BARKER, 2007 Swift St., Jacksonville, Fla. The invention relates to dredging or excavating machinery and has particular reference to certain specific improvements in hydraulic dredges or dredges which depend for their operation upon the injector action of a current of water, air, steam or the like under pressure and discharged through a contracted opening.

Pertaining to Recreation.

SWIMMING DEVICE.—E. G. ÖSTERBERG, 180 Vernon St., Worcester, Mass. This inventor provides a device for use on a person's foot to facilitate swimming, to enable the swimmer to make better speed, and to more effectively sustain the swimmer, especially when playing water polo or other aquatic games.

Pertaining to Vehicles.

LEAF SEPARATING DEVICE FOR LEAF SPRINGS.—E. I. EMERSON, Montgomery, N. Y. The object of the invention is the provision of an improved structure for spreading or



LEAF SEPARATING DEVICE FOR LEAF SPRINGS.

moving apart the various leaves of a leaf spring in order that oil or other lubricant may be placed between the leaves. Another object is to provide a readily operated tool formed with engaging points, and a compression member for being forced between the leaves of any leaf spring so as to gain access to a point between said leaves.

AUTOMOBILE TIRE TOOL.—W. J. REID, care of J. Arthur Jackson, Gananoque, Ontario, Canada. In this device the lever has its front end in the form of a rigid, forwardly-extending hook presenting an open side to receive the wheel rim and tire rim, and in connection with the said lever a tire-pressing device is provided to compress the tire transversely, the tool being rockable, as usual in tools of this character, in a plane transverse to the rims and tire.

COLLAPSIBLE GO-CART.—C. A. PIPPIN, Weldon, Ill. The object of the invention is to provide a simple, strong, and inexpensive collapsible go-cart, which when collapsed will be in the shape of a receptacle, inclosing all the parts of a go-cart, which receptacle will be convenient to carry and attractive in appearance.

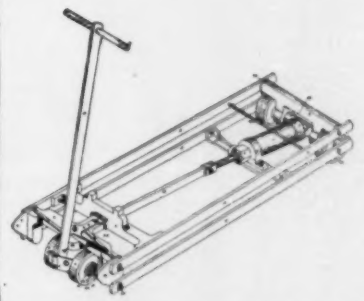
DIFFERENTIAL DRIVING MECHANISM.—A. J. CARLTON, Fellows, Cal. This improvement has reference to transmission devices for automobiles and the like, and has particular reference to a novel means serving the purpose of the usual differential gear mechanism associated usually with the driving axle of a vehicle.

AUTOMOBILE NUMBER DISPLAY DEVICE.—G. B. MULLEN, 18th St. and 7th Ave., Whitestone, L. I., N. Y. In this invention the improvement has reference to license numbers for automobiles and other vehicles, and relates more particularly to an illuminated device of such design that it can be readily seen by day as well as by night.

REVOLVING DUMP CART.—E. G. LEDYARD, Sioux Falls, S. D. It is the design in the present patent to provide a dump cart especially adapted for use in grading, road work and the like, and in which the body or pan is mounted to revolve on a horizontal axis for dumping the load.

SPRING WHEEL.—S. BROWN, care of Summers Brown & Sons, Ltd., 40 Whitecross St., London, England. This invention relates to improvements in that type of resilient vehicle wheels in which resilient spokes are employed, and the aim is to simplify the construction of such wheels by reducing the number of parts, lessening the friction of the moving parts, and increasing the elasticity of the wheel as a whole.

ELEVATING TRUCK.—E. M. CHAPMAN and C. E. COWAN. Address National Scale Company, Chicopee Falls, Mass. This truck makes unnecessary the constant rehandling and repiling of materials. Loads, to be moved, are stored on wooden platforms made in the form of tables, skids, or work benches, under which is placed the elevating truck. Pulling the



ELEVATING TRUCK WITH HYDRAULIC CHECK.

handle downward raises the loaded platform from the floor. After conveying it to the desired location, pressing a handle release mechanism which operates the hydraulic check, allowing the load to slowly descend to the floor without shock or jar or danger to the operator from a flying handle. The truck is then in readiness for the next load.

Designs.

DESIGN FOR A SWIVEL FOR EXERCISERS.—D. G. DANIELS, 232 E. 42nd St., New York, N. Y. In this ornamental design for a swivel for exercisers one view shows a side elevation of a swivel and the other an end elevation thereof, both views showing the new design.

DESIGN FOR A PENCIL GUARD AND CLIP WITH ATTACHED RUBBER.—F. ECKERMANN, care of Rio Grand Valley Bank and Trust Co., El Paso, Tex. In this ornamental design, the pencil guard, clip, and rubber are shown in three positions, rear elevation, front elevation, and side elevation.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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War Experiences of an Air Scout

(Concluded from page 520.)

enough beds for one half of the recruits, I would be obliged to sleep upon the floor like the rest. He informed me through my fellow aviator, Flieux, that owing to the great number of wounded soldiers arriving at Havre he was obliged to send nearly half of the beds to the neighboring hospitals and private residences to accommodate the wounded. I decided to remain at one of the hotels and await my reply.

The next morning I returned to the recruiting bureau for my reply, but there was none and I must come again in the evening, though the commandant informed me that it might take many days. I still saw many of those reservists who had come over with me waiting for an interview, they had waited throughout the entire day before in a very disorderly line, and, there being but one officer to see them, were obliged to retire at nightfall and return again at daybreak.

Four days later the answer from the Minister of War arrived, and I was ordered to report to the second aviation reserve at Tours, where I would have to pass the French examination for pilot. This was a simple test, as the requirement was that I take an aeroplane up 7,000 feet and remain at or above that altitude for an hour at least.

During the four-day stay at Havre I had an opportunity to see something of the town. Nearly all factories were closed, and the sight of women, both young and old, sweeping the streets clean and collecting the fares on the tramways was rather peculiar. I also had the opportunity of inspecting in detail two of the armored trains, equipped with heavy guns, which fired a shell about 6 inches in diameter, almost at any angle, even at the speedy aeroplane. The gun was loaded from the ammunition car, in which was located an observation tower, which permitted the observer to get the range of the enemy and direct the firing from a height of 30 feet. Four jacks held the train to the tracks while firing was in progress. They were to have left for the front in a couple of days.

Barricades of Paris.

I left Havre for Tours on September 18th. I had to go to Paris first and then change for Tours. It took 11 hours to travel from Havre to Paris, and I was obliged to sit up the entire night. I had time in Paris to see many of the preparations made to receive the Germans, in case the city had to stand a siege. All of the stores that were closed had their fronts boarded. At the point where Avenue de la Grande Armee terminates in the wall surrounding Paris a temporary barricade had been hastily erected of 3-inch by 12-inch by 16-foot spruce planks running from the wall close to the tramway tracks. Holes had been provided in the planks every three feet from which to operate machine guns. Directly in front of this barricade a ditch had been dug similar to that which surrounds the wall about Paris, and in front of the ditch upon the once beautiful boulevard, opposite which the "Luna Park" is located, huge trees and branches had been strewn. In the Bois de Boulogne, a park just beyond the wall, thousands of head of cattle were grazing peacefully. The Eiffel Tower was surrounded by a strong wooden fence and guarded day and night by soldiers. The only factories operating were those that were turning out supplies for the government; the remainder were closed through lack of men. The streets were filled with people, and the restaurants and wine shops did a thriving business. After 8 o'clock, however, they were closed.

A Train Load of Wounded Soldiers.

I managed to get a train for Tours the night of the 19th. It was crowded with wounded soldiers, many of whom had to stand because of the lack of seats. I gave up my seat to a wounded man. He had been shot in the hip and the bullet was still in the wound. He had also been struck by a clubbed gun in the hands of an enemy, and his head was in bad shape. His suffering was intense, but the fact that he could travel all night in one position, and with very few groans, demonstrated to me some of the nerve and determination that the French soldiers possess.

It was not fun for me to stand all night, and I certainly was relieved when the train drew into St. Pierre les Corps, where it was necessary to change trains. Five minutes later we drew into the city of Tours. One of the first sights I saw after I had shown my papers to the soldiers guarding the railroad station was an aeroplane flying over the city. It gave me a decided thrill, for I had come 3,500 miles to do just what the man over my head was doing, and I wanted to get into action as soon as I could.

A few moments later I had the pleasure of viewing about two dozen German soldiers and half a dozen officers, prisoners of war, who were now on their way to the south of France. They were rather sick looking, but seemed to feel rather happy at being in French hands. None of them wore a hat, for these had been taken as souvenirs. I speak a little German, and when I asked one of the officers with the captives if he had been in battle with the English soldiers he appeared surprised to learn that the British were also in battle against the Germans. He said he understood that the English were fighting on the German side. He really doubted my word when I told him the British were his foes, and the others shook their heads unbelievingly when he told them the news I had communicated to him.

Accepted for Service in the Aviation Corps.

I presented my papers to Capt. Duperron, the officer in command of the Second Aviation Reserve, and after convincing him also of my ability as a birdman, I was accepted for the service. I had to undergo another physical examination because the commandant at Havre had failed to mention in the papers that I had already passed the test. After passing this second examination I signed up immediately with the French for the period of the war.

An order for my uniform was given me, and I stopped at the clothing department on my return to the aviation headquarters. This department, at first sight, put me in mind of a second-hand clothing store in New York city, or rather it was like some of the stores along the Bowery which attract the attention of sightseers by their oddity. There were uniforms of all kinds and bags of clothing strewn everywhere. Apparently the officer in charge was making a list of the clothing at hand for, after waiting about two hours, he informed me that it was too late to outfit me that day and I should return the next morning. The trousers, with the red stripes, given me were new, but the coat, vest, tie, and cap were old and had been worn by some soldier before me. The shoes furnished me were so heavy that I decided to retain my own, and I was paid 15 francs ($3) for them. I did receive a new leather coat, a helmet, gloves, goggles, and a sweater, all of which I have since found exceedingly useful.

The Pilots' Quarters.

Palace Hotel was the name given by the pilots to their quarters, because it is nothing like a hotel and bears no resemblance to a palace. It was formerly a large barn and was converted (without much conversion either) into a place for the pilots to sleep. There was absolutely no ventilation whatsoever in the building, other than the large sliding door, which was generally kept closed. It did not look at all inviting to me; but I realized that I was now in the service of France and had to do as my superior officers commanded. After securing an order, I went to headquarters and was given two bags and two blankets. The bags I filled with straw and used one for a mattress and the other for a pillow. A fellow Russian pilot loaned me a sheet for my bed, when he saw me turning up my nose in disgust at the sight of the soiled bags. This was the only thing about the bed that was clean, and I was thankful to get it. I

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Inquiry No. 9401. Wanted the name and address of the owner of a second hand aeroplane motor from 20 to 30 H.P.

Inquiry No. 9402. Wanted the name and address of a manufacturer who can make a tin toy.

Inquiry No. 9403. Wanted the name and address of a glass manufacturer who can blow a small glass article to order.

Inquiry No. 9404. Wanted the name and address of a manufacturer of a tool for cutting nicks in plate glass used for name plates and house numbers.

Inquiry No. 9405. Wanted the name and address of a manufacturer who is able to supply an attachable eyelet, aluminum or celluloid through which a snap fastener would work.

Inquiry No. 9406. Wanted the name and address of a manufacturer who can supply insole material in rolls. The material seems to be scrap leather composed and attached to a canvas bottom.

Inquiry No. 9407. Wanted the name and address of some patented mechanical device which saves money or time or both, which if properly handled will bring a large demand. It must not be too expensive. It may be electrical as well as mechanical. A first class article desired.

Inquiry No. 9408. Wanted the name and address of a manufacturer or distributor of a machine which will clean both single and double burlap bags; especially heavy bags.

Inquiry No. 9409. Wanted to secure a patented device which can be manufactured at small cost and around which a good business could be built.

Inquiry No. 9410. Wanted the name and address of manufacturers of "Scuffer Shoes."

Inquiry No. 9411. Wanted the name and address of a gas lighter using some form of platinum black which ignites by holding over a flow of gas.

Inquiry No. 9412. Wanted the name and address of a manufacturer that makes machinery for making bichrome ribbons for typewriters.

Inquiry No. 9413. Wanted the name and address of a manufacturer of calendar clips for pencils or pens. Miniature pad tears off same as large calendar pads. Celluloid protecting shield.

Inquiry No. 9414. Wanted the name and address of a manufacturer who will make an armchair with an adjustable foot rest.

slept well and forgot all about the repugnance I felt for my bed and my quarters. This was largely due to the fact that I had had little or no sleep while on the trains from Havre to Tours.

Meals were served to the pilots in an old barn, about five minutes' walk from the aviation field. Dinner was served at half past six that night. I was introduced to the pilots present (about sixty), and they greeted me with cheers when they learned that I had come from America to fight with them. Some who knew the American national anthem sang it, and I was made to feel at home at once. I felt that I was where I belonged at last, and room was made for me at the rough table by several of the pilots squeezing together on a bench and telling me to sit down.

I found the dinner a fairly good one, and when I commented upon it to my neighbor (many of the pilots could talk very good English) I was told that it was good because the day was Sunday—a fact I had not realized until then.

The food furnished the aviators is the same as the rations given the common soldier. Each pilot, however, by paying 50 centimes (10 cents) a day, received in addition to the boiled beef and potatoes furnished by the government a piece of cheese, fruit, and a bottle of wine, which was divided among four. The dining-room was an old barn and very dirty. The stones were crumbling with age, and from inquiries I made about it I learned that the barn had stood at least two centuries.

World-famous Aviators.

Some of my fellow pilots were quite prominent in the flying game. Others of them were very wealthy. It seemed odd to me to think that we should all be eating at the same table and sleeping in the same room, receiving no more consideration than was given the average French soldier. Among the pilots present were Jules Vedrines, the speed king, who won the Gordon Bennett race at Chicago two years ago; Count de Lambert, the oldest aviator in France and who was the first to learn from the Wright brothers (he was now taking instructions on the Voissan biplane); Fournier, the holder of the French endurance record of 13 hours for many years; Simon (the fool flyer), well known in the United States; Jensen, from Denmark, who months ago flew from France completely across Germany without alighting to land in Russia, one of the longest non-stop cross-country flights on record; and many others too numerous to mention. Messrs. Vedrines, Count de Lambert, and Fournier were holders of the legion of honor medal, and wore it prominently displayed on their breasts. There were also many pilots of foreign birth present, among them three Russians, several Englishmen, two Belgians, two Italians, and one Spaniard, but, apparently, I was the only American enrolled.

That night some of the pilots had a pillow fight in the Palace Hotel; but I was too tired to mind it. Later on, however, the pillow fights became a regular affair every evening, and sometimes in the morning, and proved to be very amusing, especially when considering that the pillow fights were the nearest to a real battle that some of them would ever get.

(To be continued.)

Air Transparency for Infra-red Rays

(Concluded from page 521.)

be filtered out of it for photographic purposes, only such objects as would stand at less than 33 feet from the objective would appear on the photograph, as a layer of air but 10 meters thick is completely opaque to such radiations. In the neighborhood of 1,842 A. U. even a layer of air one meter thick will stop such ultra-violet light.

When sensitizing plates for infra-red light the experimenter will get excellent and steady results from the use of the following bath; the volume of which is calculated for a 5 by 7 plate:

Alcohol at 50%.....200 cubic centimeters
Ammonia ..... 4 cubic centimeters
Alizarin blue S.....0.04 gramme
Silver nitrate solution at 10%.....5 drops

All of these chemicals are placed into separate vials. When it is desired to sensitize the plate the ammonia and the alizarin blue are introduced into the alcohol; the flask is stoppered and agitated for about 5 minutes, to favor the disolution of the dye. The solution is then filtered into a flask which contains the five drops of the silver nitrate solution. The liquid is moved again and poured over the plate into a 5 by 7-inch dish, which is rocked while the bath acts during exactly 3 minutes. The plate is then washed for 3 minutes in running water. After the back has been wiped dry with blotting paper it is laid vertically in a light-proof box, the bottom of which is covered with a layer of blotting paper, and which contains a dish full of fused calcium chloride. About one hour later it may be placed into the plate holder.

From the filtration of the bath until the placing of the plate into the plate holder, every operation must be done in complete darkness or with the help of a very faint green light of the proper kind, i. e., made expressly for plates sensitive to the red and beginning of the infra-red.

Strategic Moves of the War

(Concluded from page 522.)

been completely destroyed in the campaigns back and forth across this district. The advantage in this respect now lies very appreciably with the Russians. Their base at Warsaw lies close to an important part of the battle line, while their troops farther to the south have the advantage of operating in home territory.

Now that the first rush of the German army is checked, the outcome of the fighting in this central portion of the battle line depends quite largely on which side can most rapidly move to the front reinforcements of men and guns. In this the Russians should have a decided advantage. The fighting in this district bids fair now to develop into a deadlock similar to that in France.

In case the combatant forces in Poland succeed in entrenching themselves so strongly as to bring the campaign there to a deadlock, the immense numbers of the Russian army will give them the advantage in the next move of the campaign. This will consist in extending the lines northward as fast as troops can be moved to the front, just as occurred in France during September and October. The district between the Vistula and the East Prussian border will first acquire added importance. If the decision is not reached here the active fighting will again return to East Prussia for the determination of the great battle in northern Poland.

The operations in East Prussia during the week have been of minor importance. The Russians claim now to have advanced to Lotzen, on the eastern edge of the lake region. The battle line in this district now starts southwest of Johannisburg and runs through Arys, Lotzen, Darkehmen, Gumbinnen, and Pillkallen. Both of the contending nations seem to have slackened operations in this district while waiting for the outcome of the great battle in Poland.

Considering this campaign as a whole, the result of the week's fighting has been as an even exchange. The Russians have defeated the German effort to advance southward from East Prussia toward Warsaw and have driven this force back to a position near the German border. In the south the Austrians have succeeded in the first stage of their campaign against the Russians' left flank and have forced the Russians to retreat from their position southeast of Cracow.

The Campaign in Turkey.

At the mouth of the Euphrates River the British Indian force has taken possession of the river for one hundred miles from its mouth. The capture of Kurna, where the Tigris joins the Euphrates, gives them an important strategic point for the control of this region. There is little to be gained by a further advance unless the Turkish resistance should prove

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Page 520 of this number

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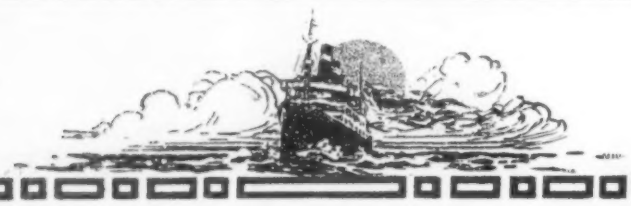

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so weak that a small force can overrun southern Mesopotamia.

The arrival on the Isthmus of Suez of the contingent from Australia and New Zealand will greatly strengthen the British defense of the canal. No operations in this district have been reported since the repulse of the Arab raiding party that penetrated within eighteen miles of the canal.

The campaign along the Caucasian border is still going against the Russians. The Turks now control the strip of territory south of Batum lying between the Chorok River and the border. Farther to the east the Russians have crossed the border and have entered the headwaters of the Euphrates River.

The Servian Campaign.

The farthest advance of the Austrians into Servia reached the line joining Belgrade with Uzice, eighty miles to the southwest. On December 9th the Servians delivered their counter blow by attacking the left wing of the Austrian army south of Belgrade. The Austrian resistance was overcome and their army was forced to fall back to a new line running from Rogacica, near the Bosnian border, northeast along the Kolubara River to Belgrade.

The influence of the Russian campaign is shown in the success of the Servians. The Austrian advance was made by an army of seven corps. When Belgrade was captured and the Russians were invading Hungary through the Carpathian Mountains the pressure was so great that three corps were taken from Servia to make the flank move against the Russians *via* Dukla and Jaslo.

The Servians discovered this reduction in the strength of the army of invasion under Gen. Potiorek and launched their attack south of Belgrade. When this flank gave way they transferred their attack to the center and broke down the Austrian resistance. The Austrian right flank made a hasty retreat across the Drina River, where they were caught in flank by the Montenegrins at Vishegrad in Bosnia. The Austrian center fell back with large losses to a position between Loznica and Sabac in the northwest corner of Servia. Their left wing abandoned Belgrade to the Servians and crossed the Save River to Austrian territory. This great victory of the Servians has at one blow cleared their territory of the invading army except for the small corner between the Drina and the Save rivers.

Hindu Jugglery

(*Concluded from page 526.*)

is called at the end of the trick, as above. Of course the basket has a double side at the back, not a double bottom, and when showing the open basket before the trick, the false side is slipped back to show the full width. Merely as a wrong scent, the juggler turns over the basket with its face to the ground and beats it on the back with his sword, as if that were the convincing way of showing it to be empty. Thus, when the second girl is in the basket and she has crept into the false compartment, which she has placed in position, the juggler shows the open basket and very quickly turns it on its face and beats it on the back as before, merely to convince the spectators by the association of ideas that the basket is empty and thus to prevent them from noticing the diminished width due to the false compartment.

The juggler is careful to thrust in the sword at several places on the longitudinal line of the middle of the basket, so as to avoid the false compartment; and as the sword is obviously thrust down as far as it will go, the spectators are duly deceived, and the second girl still remains in the hidden compartment till the spectators are examining the first girl miraculously come back to life, and the basket and cloak are removed by the assistants. Then, during the next feat, which follows in quick succession, she emerges at the back of the assistants, puts on the cloak, and slips away. The blood is only liquid pigment.

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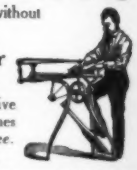

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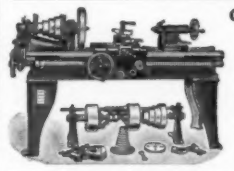

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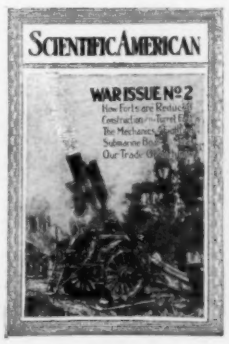

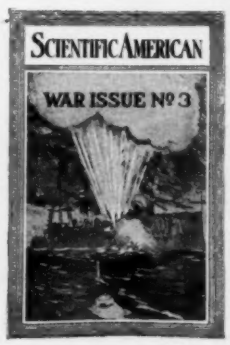

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